Laboratory for Advanced Software Systems
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iCrash :
A Crisis Management Case Study
Messir Analysis Document
- v 1.4 -

(*Report type: Specification*)

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Chapter 1

Introduction

1.1 Overview

iCrash is a simple system dedicated to any person who wants to inform of a car crash crisis situation in order to allow for crisis handling. At anytime and anywhere, anyone can be the witness or victim of a car crash and might be in a situation allowing for alerting this crisis. The *iCrash* system has for objectives to support crisis declaration and secure administration and crisis handling by the *iCrash* professional users.

1.2 Purpose and recipients of the document

This document is an analysis document complying with the Messir methodology [?]. Its intent is to provide an example of a precise specification of the functional properties of the *iCrash* system.

The recipients of this document are:

- the *iCrash* system's buyer company (ABC): this document is used as a contractual document jointly with any other document considered as useful (as requirement elicitation document, ...) in order to have a higher degree of precision in requirement description. It is also used as a basis document for the *iCrash* system validation using specification based testing.
- the *iCrash* system development company (ADC) is expected to use this document as the basis for development (mainly design, implementation, maintenance). It is also used for verification and validation using test plans defined using the analysis models described in this document and according to the Messir methodology.

1.3 Application Domain

The *iCrash* system belongs to the Crisis Management Systems Domain. It is a system dedicated to crisis professional and non professional end users. It has to be considered as an autonomous and external service for the society. It is not an institutional system certified and guaranteed by any governmental entity and thus, must be used with caution.

1.4 Definitions, acronyms and abbreviations

N.A.

1.5 Document structure

The document structure is designed to be coherent with the Messir methodology [?]. Section 2 provides a general description of the system purpose, its users, its environment and some general non functional requirements. A more detailed description of the non functional requirements, if any, are provided in section **??**. The system operation triggered by events sent by the external actors belonging to the environment are described in Section 3. The *iCrash* concepts used to represent the any persistent or transient information is given in Section 4. The precise specification of the system operations in term of system's state changes, events sent together with the constraints on the allowed sequences of system operations are described in Section 5.

Chapter 2

General Description

In the context of the Messir method, the information provided in this section is intended to present the system for which the Messir analysis is provided. The content of this section is made accordingly to the requirements elicitation document that might have been done during the project but also adapted coherently in order to be an abstract introduction to the Messir analysis.

2.1 Domain Stakeholders

All stakeholders of the system are detailed in this section. After a brief description of a stakeholder, its objectives are first stated. Thereafter, the responsibilities of the stakeholder are detailed which help to achieve the stakeholder objectives to a certain degree. While the objectives characterize the general problems addressed by the *iCrash* system, the responsibilities describe concrete actions that are expected from a stakeholder. Some of these responsibilities can be traced looking at the use case described in Section B.1,and hence must be supported by the *iCrash* system. All stakeholders listed in this section have an interest in the system or are affected by the system in some way, but only a subset of the stakeholders are directly involved in the use cases described. Let us remind that use case diagrams or descriptions are not Messir analysis phase mandatory outputs. They are proposed as informal means to help understanding the semantics of the system specification made of the mandatory analysis models, which provide a complete executable specification.

2.1.1 Communication Company

A Communication Company is a company that has the capacity to ensure communication of information between its customers and the *iCrash* system. The objectives of a Communication Company are:

- to be able to deliver any SMS sent by any human to the *iCrash* 's phone number.
- to be able to transmit SMS messages from the ABC company that owns the *iCrash* system to any human having an SMS compatible device accessible using a phone number.

In order to achieve these objectives, the responsibilities of a Communication Company are:

- ensure confidentiality and integrity of the information sent by a human to the *iCrash* system or from the system to a human.
- to be always available and reliable.

2.1.2 Humans

A human is any person who considers himself related to a car crash either as a witness, a victim or an anonymous person. The objectives of a human are:

- inform the *iCrash* system about the crisis situation he detected.
- be sure that the ABC company has been informed about the situation.
- to be informed about the situation of the crisis he his related to as a victim or witness.

In order to achieve these objectives, the responsibilities of a human are:

- to provide has much details as possible concerning the crisis to the ABC company.
- to declare a crisis only if the crisis is real.
- to have access to the SMS compatible communication device he used to communication with the *iCrash* system.

2.1.3 Coordinators

A coordinator is a employee of the ABC company being responsible of handling one or several crisis. The objectives of a coordinator are:

- to securely monitor the existing alerts and crisis.
- to securely manage alerts and crisis until their termination.

In order to achieve these objectives, the responsibilities of a coordinator are:

- to be capable to determine how an alert received should be considered.
- to be available to react to requests to handle alerts and crisis.
- to be autonomous in handling crisis and to report on its handling.
- to be able to decide when a crisis or an alert can be closed.
- to know its system identification information for secure usage of the system.

2.1.4 Administrator

An administrator is a employee of the ABC company being responsible of administrating the *iCrash* system. The objectives of an administrator are:

- to add or delete coordinator actors from the system and its environment.

In order to achieve these objectives, the responsibilities of a coordinator are:

- know the company employees that can be coordinators and that have access to the system.
- to know its system identification information for secure usage of the system.
- to know the security policy of the ABC company.
- to communicate the coordinators their identification information for secure system usage.

2.1.5 Creator

Any system has a `Creator` stakeholder which is a technician who is installing the *iCrash* system on the targeted deployment infrastructure.

The objectives of a `Creator` are:

- to install the *iCrash* system
- to define the values for the initial system's state
- to define the values for the initial system's environment
- to ensure the integration of the *iCrash* system with its initial environment

In order to achieve these objectives, the responsibilities of a `Creator` are:

- provide the necessary data to the *iCrash* system for its initialization.

2.1.6 Activator

An `activator` is a logical representation of the active part the *iCrash* system. It represents an implicit stakeholder belonging to the system's environment that interacts with the *iCrash* system autonomously without the need of a external entity. It is usually used for representing time triggered functionalities.

The objectives of a `activator` are:

- to communicate the current time to the system
- to notify the administrator that some crisis are still pending for a too long time.

In order to achieve these objectives, the responsibilities of a `activator` are:

- to know the current universal time
- to send the messages to the system according to the time constraints specifically defined for it.

2.2 System's Actors

The objective of this section is not to provide the full requirement elicitation document in this section but to reuse a part of this document to provide a informal introduction to the Messir specification of the system under development. The use case model is made of a use case diagrams modelling abstractly and informally the actors and their use cases together with a set of use cases descriptions. In addition, those diagrams and description tables are adapted to the Messir specification since actor and messages names together with parameters are partly adapted to be consistent with the specification identifiers (see [?] for more details).

Among all the stakeholders presented in the previous section, we can determine five types of direct actors[1]:

- `actComCompany`: for the Communication Company stakeholder.
- `actAdministrator`: for the Administrator stakeholder.
- `actCoordinator`: for the Coordinators stakeholders.
- `actActivator`: for the Activator stakeholder.
- `actMsrCreator`: for the Creator stakeholder.

In addition to those system actors, we can add five other types of actors related to the system's ones. Those five actors are grouped into two categories:

- *Indirect actors*
  - *Witness*: for any human that is a witness of a car crash
  - *Victim*: for any human that is a victim of a car crash
  - *Anonymous*: for any human that want to inform about a car crash while staying anonymous.
- *Abstract actors*
  - `actHuman`: represent abstractly any kind of human being actor wanting to communicate with the ABC system in the context of a car crash.
  - `actAuthenticated`: for the logical Activator stakeholder.

2.3 Use Cases Model

This section contains the use cases elicited during the requirements elicitation phase. The use cases are textually described as suggested by the Messir method and inspired by the standard Cokburn template [?].

2.3.1 Use Cases

2.3.1.1 summary-suDeployAndRun

The goal is to install the iCrash system on its infrastructure and to exploit its capacities related to the secure administration and efficient handling of car crash situations depending on alerts received.

[1]The naming conventions in Messir propose to start each type name by lowercase letters indicating the meta model type used (i.e. act for actors, ct for class type, ... In addition to ease the reading it makes the translational semantics into Prolog code more straightforward.

Use-Case Description	
Name	suDeployAndRun
Scope	system
Level	summary
Primary actor(s)	
1	actAdministrator[active]
Secondary actor(s)	
1	actMsrCreator[active]
2	actCoordinator[active, multiple]
3	actActivator[proactive]
4	actComCompany[active]
Goal(s) description	
The goal is to install the iCrash system on its infrastructure and to exploit its capacities related to the secure administration and efficient handling of car crash situations depending on alerts received.	
Reuse	
1	oeCreateSystemAndEnvironment [1..1]
2	ugAdministrateTheSystem [1..*]
3	suGlobalCrisisHandling [1..*]
4	oeSetClock [1..*]
5	oeSollicitateCrisisHandling [0..*]
6	oeAlert [1..*]
Protocol condition(s)	
1	the iCrash system has never been deployed and used
Pre-condition(s)	
1	none
Main post-condition(s)	
1	the iCrash system has been created and has handled the crisis situations for which it received alerts through the communication company.
Main Steps	
a	the actor actMsrCreator executes the oeCreateSystemAndEnvironment use case
b	the actor actAdministrator executes the ugAdministrateTheSystem use case
c	the actor actComCompany executes the oeAlert use case
d	the actor actActivator executes the oeSetClock use case
e	the actor actActivator executes the oeSollicitateCrisisHandling use case
f	the actor actCoordinator executes the suGlobalCrisisHandling use case
Steps Ordering Constraints	
1	step (a) must be always the first step.
2	step (f) can be executed by different actCoordinator actors.
3	if (e) then previously (d).

Figure 2.1 shows the use case diagram for the suDeployAndRun summary use case

2.3.1.2 summary-suGlobalCrisisHandling

the actCoordinator's goal is to monitor the alerts received and the corresponding crisis in order to act as necessary to handle the crisis.

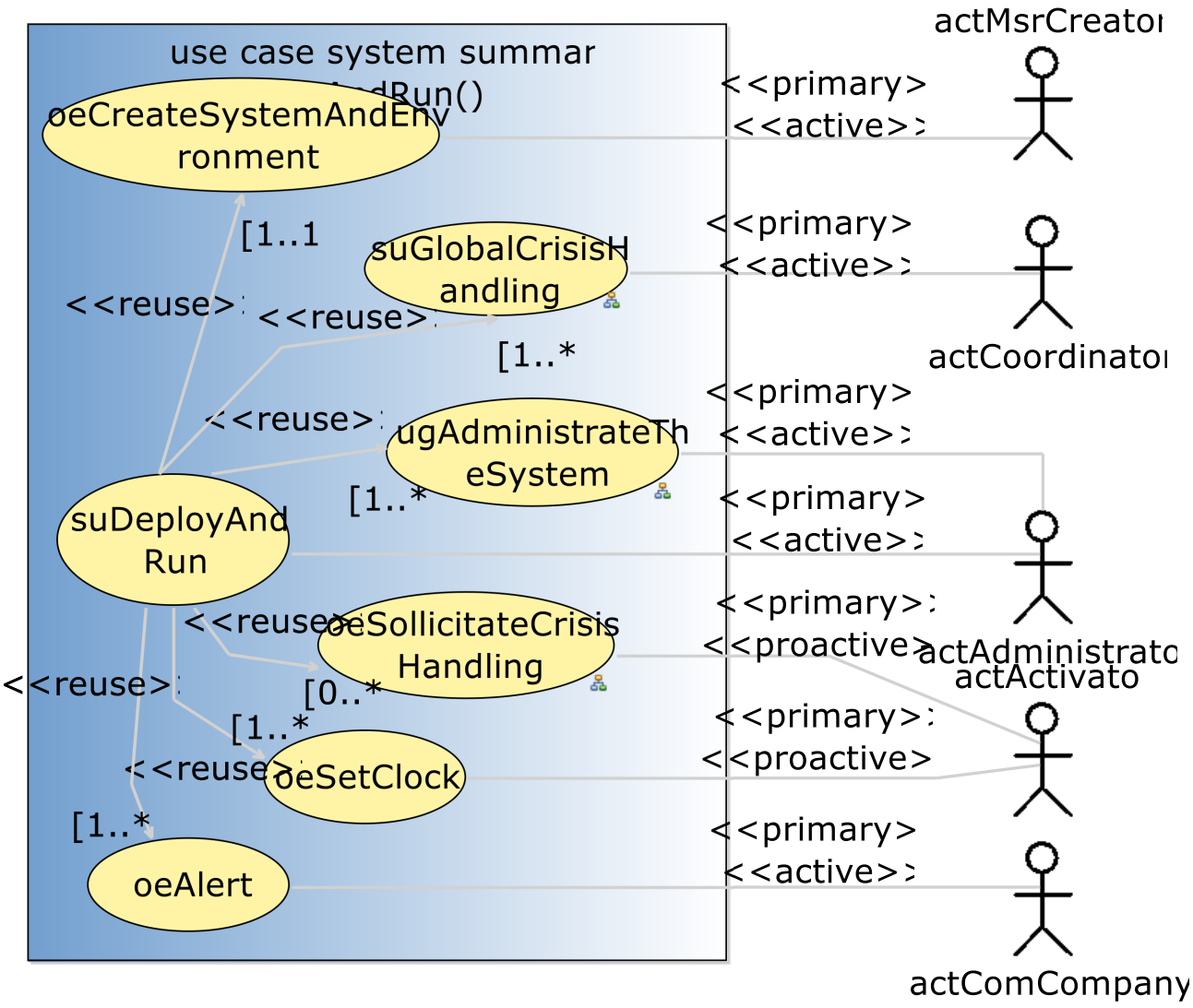


Figure 2.1: suDeployAndRun summary use case

Use-Case Description	
Name	suGlobalCrisisHandling
Scope	system
Level	summary
Primary actor(s)	
1	actCoordinator[active]
Goal(s) description	
the actCoordinator's goal is to monitor the alerts received and the corresponding crisis in order to act as necessary to handle the crisis.	
Reuse	
1	ugSecurelyUseSystem [1..*]
2	ugMonitor [1..*]
3	ugManageCrisis [1..*]
Protocol condition(s)	
1	the iCrash system has been deployed
2	the coordinator actor involded in the use case has been declared by the actor actAdministrator
Pre-condition(s)	
1	none
Main post-condition(s)	
1	modifications have been made by the coordinator on existing alerts or crisis OR the coordinator requested an updated status on existing alerts or crisis.
Main Steps	
a	the actor actCoordinator executes the ugSecurelyUseSystem use case
b	the actor actCoordinator executes the ugMonitor use case
c	the actor actCoordinator executes the ugManageCrisis use case
Steps Ordering Constraints	
1	steps (a) (b) and (c) executions are interleaved (steps (b) and (c) have their protocol constrained by steps of (a)).
2	steps (a) (b) and (c) can be executed multiple times.

Figure 2.2 shows the use case diagram for the suGlobalCrisisHandling user goal use case

2.3.1.3 usergoal-ugAdministrateTheSystem

the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.

Use-Case Description	
Name	ugAdministrateTheSystem
Scope	system
Level	usergoal
Primary actor(s)	
1	actAdministrator[active]
Goal(s) description	
the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.	

continues in next page . . .

... Use-Case Description table continuation

Reuse	
1	ugSecurelyUseSystem [1..*]
2	oeAddCoordinator [1..*]
3	oeDeleteCoordinator [0..*]
Protocol condition(s)	
1	the iCrash system has been deployed
Pre-condition(s)	
1	none
Main post-condition(s)	
1	modifications have been made to the system and its environment concerning existing or new coordinators.
Main Steps	
a	the actor actAdministrator executes the ugSecurelyUseSystem use case
b	the actor actAdministrator executes the oeAddCoordinator use case
c	the actor actAdministrator executes the oeDeleteCoordinator use case
Steps Ordering Constraints	
1	steps (a) (b) and (c) executions are interleaved (steps (b) and (c) have their protocol constrained by steps of (a)).
2	steps (a) (b) and (c) can be executed multiple times.

Figure 2.3 shows the use case diagram for the ugAdministrateTheSystem user goal use case

2.3.1.4 usergoal-ugAverageTypeofCrisis

An actor has been login as a Administrator to use the statistic function. So he can see the average time for the different types of a crises

USE-CASE DESCRIPTION	
Name	ugAverageTypeofCrisis
Scope	system
Level	usergoal
Primary actor(s)	
1	actAdministrator[active]
2	actDatabase[proactive]
Secondary actor(s)	
1	actSystem[active]
Goal(s) description	
An actor has been login as a Administrator to use the statistic function. So he can see the average time for the different types of a crises	
Reuse	
1	oeStatistic [1..*]
2	ugSercurelyUserSystem [0..*]
3	oeTimeOfTypeOfCrisis [0..*]
4	ugAdministrateTheSystem [1..*]
Protocol condition(s)	

continues in next page . . .

... Use-Case Description table continuation

1	The actor has been login as a administrator and he has to click on the button static.
2	The actor must be able to access the system (connected to the internet)
Pre-condition(s)	
1	The actor is not login as a administrator, so he can click the button statistic.
Main post-condition(s)	
1	if the login was successful, the actor is now identified and thus able to access the AdministrateTheSystem
2	The actor can click the button statistic and so he see the statistic
Main Steps	
a	the actor `actSystem` executes the `ugSercurelyUserSystem` use case
b	the actor `actSystem` executes the `oeStatistic` use case
c	the actor `actAdministrator` executes the `oeTimeOfTypeOfCrisis` use case
d	the actor `actAdministrator` executes the `ugAdministrateTheSystem` use case
e	the actor `actDatabase` executes the `oeTimeOfTypeOfCrisis` use case
Steps Ordering Constraints	
1	at least a
2	if b then previously a
3	if c then previously b
4	if d then previously c
Additional Information	
none	

Figure 2.4 The actor administrator will open the statics the average time for each type of crises,there the administrator can find out how long the different types of crisis needs.The tree types of a crises are small, medium and huge . Also the abstract user System give the information

2.3.1.5 usergoal-ugCrisisInTime

An actor has been login as a Administrator to use the statistic function. So he can see the number of crises compared with the time

USE-CASE DESCRIPTION	
Name	ugCrisisInTime
Scope	system
Level	usergoal
Primary actor(s)	
1	`actAdministrator[active]`
2	`actDatabase[proactive]`
Secondary actor(s)	
1	`actSystem[active]`
Goal(s) description	
An actor has been login as a Administrator to use the statistic function. So he can see the number of crises compared with the time	
Reuse	
1	`oeStatistic [1..*]`
2	`ugSercurelyUserSystem [0..*]`

continues in next page . . .

... Use-Case Description table continuation

3	oeNumberOfCrisis [0..*]
4	ugAdministrateTheSystem [1..*]
Protocol condition(s)	
1	The actor has been login as a administrator and he has to click on the button static.
2	The actor must be able to access the system (connected to the internet)
Pre-condition(s)	
1	The actor is not login as a administrator, so he can click the button statistic.
Main post-condition(s)	
1	if the login was successful, the actor is now identified and thus able to access the AdministrateTheSystem
2	The actor can click the button statistic and so he see the statistic
Main Steps	
a	the actor actSystem executes the ugSercurelyUserSystem use case
b	the actor actSystem executes the oeStatistic use case
c	the actor actAdministrator executes the oeNumberOfCrisis use case
d	the actor actAdministrator executes the ugAdministrateTheSystem use case
e	the actor actDatabase executes the oeNumberOfCrisis use case
Steps Ordering Constraints	
1	at least a
2	if b then previously a
3	if c then previously b
4	if d then previously c
Additional Information	
none	

Figure 2.5 The actor administrator will open the statics The number of crisis at the time, there he can find out how many crisis are send at the different time. Also the abstract user System give the information

2.3.1.6 usergoal-ugLogin

An actor wants to identify himself in order to gain access to the systems functionalities

Use-Case Description	
Name	ugLogin
Scope	system
Level	usergoal
Primary actor(s)	
1	actAuthenticated[active]
Secondary actor(s)	
1	actCaptchaGenerator[active]
2	actCaptchaValidator[active]
3	actMailingService[active]
Goal(s) description	
An actor wants to identify himself in order to gain access to the systems functionalities	
Reuse	

continues in next page ...

... Use-Case Description table continuation

1	oeLogin [1..1]
2	oeSendCaptcha [1..1]
3	oeSubmitCaptcha [1..1]
4	oeCaptchaInvalid [1..1]
5	oeCaptchaValid [1..1]
Protocol condition(s)	
1	the system has to be started
2	the actor (client) must be able to access the system (connected to the internet)
Pre-condition(s)	
1	the actor is not identified (logged in) and thus not able to access the systems functionalities
Main post-condition(s)	
1	if the login was successful, the actor is now identified and thus able to access the systems functionalities
2	if an attempt to log in failed, the authentication is refused and the actor has to try again
3	if the actor failed three times to log in, each further attempt to log in is accompanied by a captcha verification test
4	if the actor failed three times to log in without and five times with captcha verification, the requested user name will be blocked from further log in attempts
Main Steps	
a	the actor actAuthenticated executes the oeLogin use case
b	the actor actCaptchaGenerator executes the oeSendCaptcha use case
c	the actor actAuthenticated executes the oeSubmitCaptcha use case
d	the actor actCaptchaValidator executes the oeCaptchaInvalid use case
e	the actor actCaptchaValidator executes the oeCaptchaValid use case
Steps Ordering Constraints	
1	at least a
2	if b then previously a
3	if c then previously b
4	if d then previously c
5	if e then previously c
Additional Information	
none	

Figure 2.6 An actor tries to log in to the system using his credentials

2.3.1.7 usergoal-ugManageCrisis

The goal is to do an action that makes the handling of a crisis or an alert progress.

USE-CASE DESCRIPTION	
Name	ugManageCrisis
Scope	system
Level	usergoal
Primary actor(s)	
1	actCoordinator[active]
Goal(s) description	

continues in next page ...

... Use-Case Description table continuation

The goal is to do an action that makes the handling of a crisis or an alert progress.	
Reuse	
1	oeValidateAlert [0..*]
2	oeSetCrisisStatus [0..*]
3	oeSetCrisisHandler [0..*]
4	oeReportOnCrisis [0..*]
5	oeCloseCrisis [0..*]
6	oeInvalidateAlert [0..*]
Protocol condition(s)	
1	the iCrash system has been deployed
Pre-condition(s)	
1	none
Main post-condition(s)	
1	there exist one alert or one crisis whose related information has been changed.
Main Steps	
a	the actor actCoordinator executes the oeValidateAlert use case
b	the actor actCoordinator executes the oeSetCrisisStatus use case
c	the actor actCoordinator executes the oeSetCrisisHandler use case
d	the actor actCoordinator executes the oeReportOnCrisis use case
e	the actor actCoordinator executes the oeCloseCrisis use case
f	the actor actCoordinator executes the oeInvalidateAlert use case
Steps Ordering Constraints	
1	managing a crisis is doing one of the indicated use cases.

Figure 2.7 shows the use case diagram for the ugManageCrisis user goal use case

2.3.1.8 usergoal-ugMonitor

the actCoordinator's goal is to get the detailed list of existing crisis or alerts to decide on next actions to undertake.

USE-CASE DESCRIPTION	
Name	ugMonitor
Scope	system
Level	usergoal
Primary actor(s)	
1	actCoordinator[active]
Goal(s) description	
the actCoordinator's goal is to get the detailed list of existing crisis or alerts to decide on next actions to undertake.	
Reuse	
1	oeGetCrisisSet [0..*]
2	oeGetAlertsSet [0..*]
Protocol condition(s)	
1	the iCrash system has been deployed
Pre-condition(s)	

continues in next page . . .

... Use-Case Description table continuation

1	none
Main post-condition(s)	
1	none
Main Steps	
a	the actor `actCoordinator` executes the `oeGetAlertsSet` use case
b	the actor `actCoordinator` executes the `oeGetCrisisSet` use case

Figure 2.8 shows the use case diagram for the ugMonitor user goal use case

2.3.1.9 usergoal-ugSecurelyUseSystem

the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.

Use-Case Description	
Name	ugSecurelyUseSystem
Scope	system
Level	usergoal
Primary actor(s)	
1	`actAuthenticated[active]`
Goal(s) description	
the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.	
Reuse	
1	`oeLogin [1..1]`
2	`oeLogout [1..1]`
Protocol condition(s)	
1	the iCrash system has been deployed
Pre-condition(s)	
1	none
Main post-condition(s)	
1	the actAuthenticated is known by the system not to be logged.
Main Steps	
a	the actor `actAuthenticated` executes the `oeLogin` use case
b	the actor `actAuthenticated` executes the `oeLogout` use case
Steps Ordering Constraints	
1	step (a) must always precede step (b).

Figure 2.9 shows the use case diagram for the ugSecurelyUseSystem user goal use case

2.3.1.10 usergoal-ugUserActivity

An actor has been login as a Administrator to use the statistic function. So he can see the number of user compared with the time

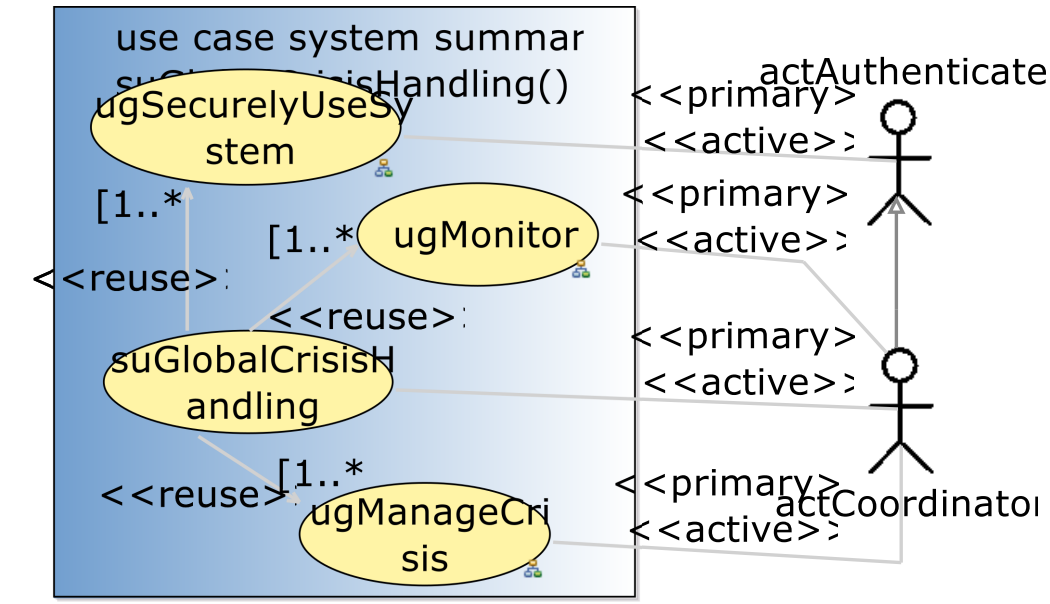


Figure 2.2: suGlobalCrisisHandling user goal use case

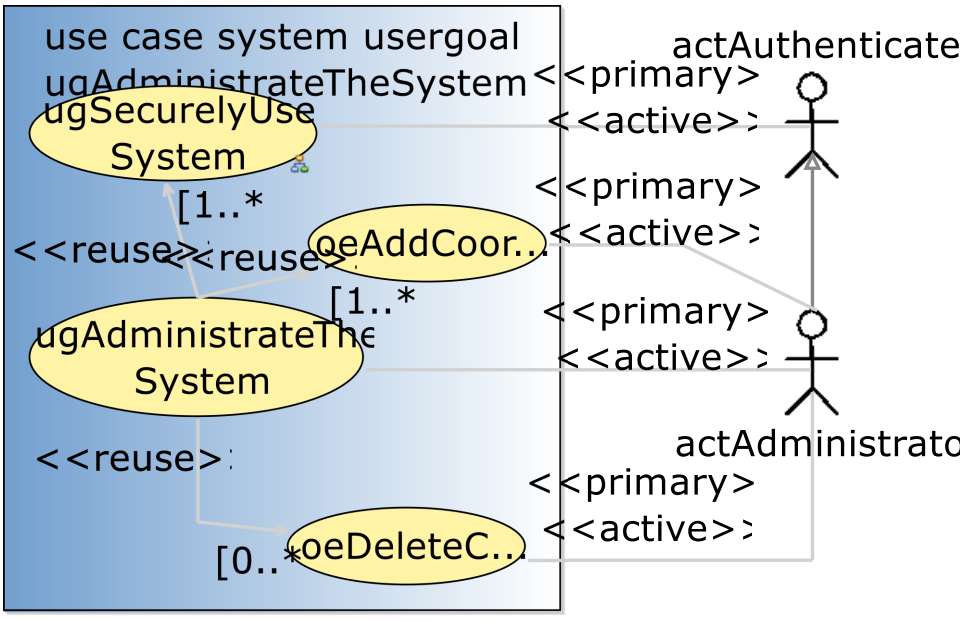


Figure 2.3: ugAdministrateTheSystem user goal use case

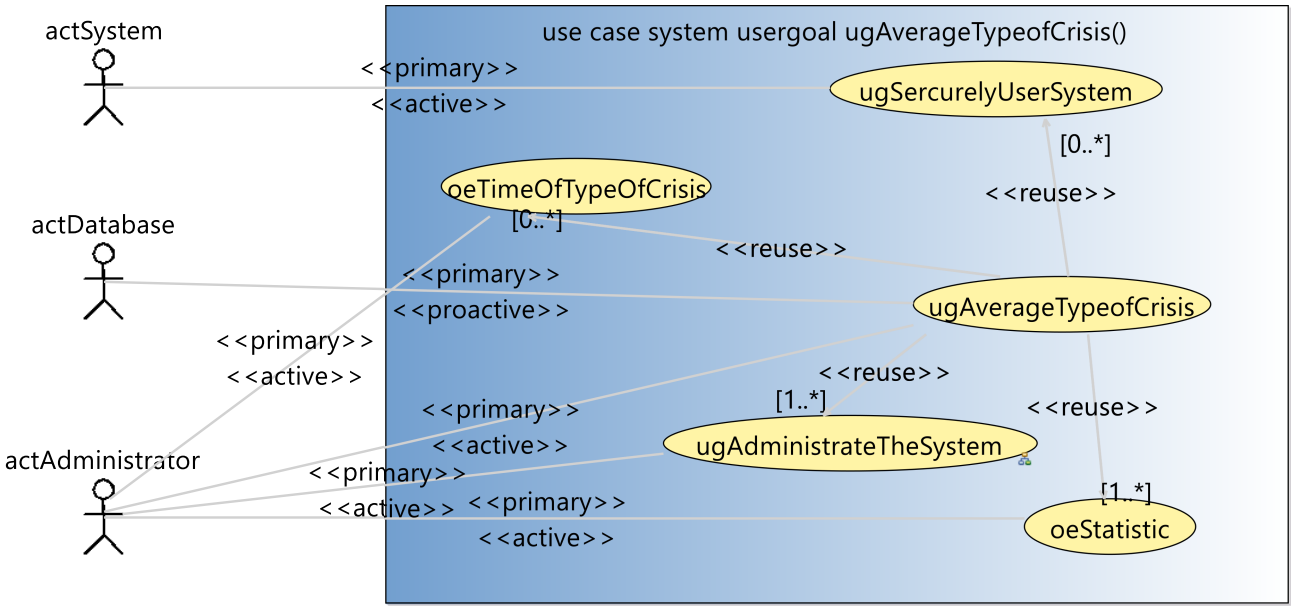


Figure 2.4: The average time for each type of crises

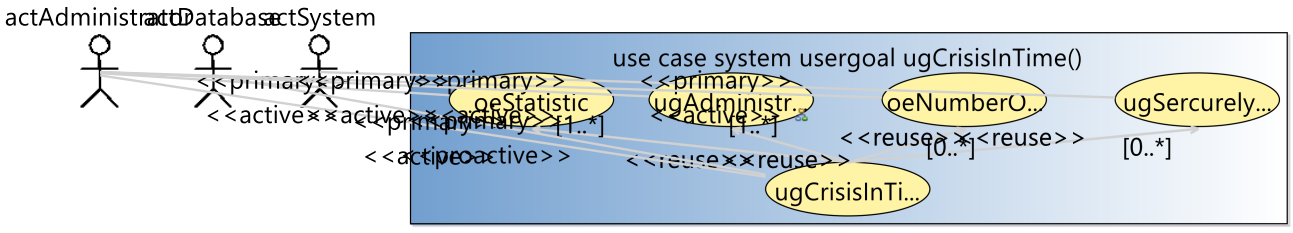


Figure 2.5: The number of crisis at the time

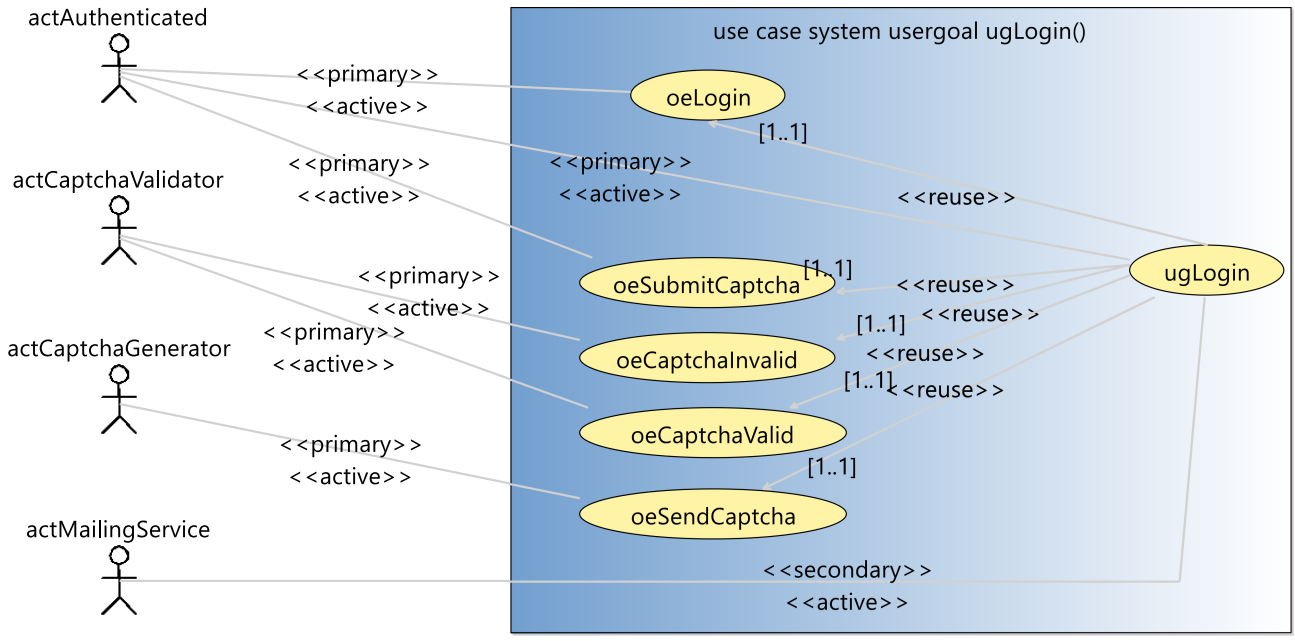


Figure 2.6: User goal: log in to the system

USE-CASE DESCRIPTION	
Name	ugUserActivity
Scope	system
Level	usergoal
Primary actor(s)	
1	`actAdministrator[active]`
2	`actDatabase[proactive]`
Secondary actor(s)	
1	`actSystem[active]`
Goal(s) description	
An actor has been login as a Administrator to use the statistic function. So he can see the number of user compared with the time	
Reuse	
1	`oeStatistic [1..*]`
2	`ugSercurelyUserSystem [0..*]`
3	`oeUserActivityStatistic [0..*]`
4	`ugAdministrateTheSystem [1..*]`
Protocol condition(s)	
1	The actor has been login as a administrator and he has to click on the button static.
2	The actor must be able to access the system (connected to the internet)
Pre-condition(s)	
1	The actor is not login as a administrator, so he can click the button statistic.
Main post-condition(s)	
1	if the login was successful, the actor is now identified and thus able to access the AdministrateTheSystem
2	The actor can click the button statistic and so he see the statistic

continues in next page . . .

... Use-Case Description table continuation

Main Steps	
a	the actor `actSystem` executes the `ugSercurelyUserSystem` use case
b	the actor `actSystem` executes the `oeStatistic` use case
c	the actor `actAdministrator` executes the `oeUserActivityStatistic` use case
d	the actor `actAdministrator` executes the `ugAdministrateTheSystem` use case
e	the actor `actDatabase` executes the `oeUserActivityStatistic` use case
Steps Ordering Constraints	
1	at least a
2	if b then previously a
3	if c then previously b
4	if d then previously c
Additional Information	
none	

Figure 2.10 The actor administrator will open the statics the activity of the users, there he can find out how many users are active at any time. Also the abstract user System give the information

2.3.1.11 usergoal-ugVictimSendFamilyNotification

USE-CASE DESCRIPTION	
Name	ugVictimSendFamilyNotification
Scope	system
Level	usergoal
Primary actor(s)	
1	`actSystem[active]`
Secondary actor(s)	
1	`actAuthenticated[active]`
2	`actCoordinator[active]`
Goal(s) description	
Reuse	
1	`oeCreateAlert [1..*]`
2	`oeValidateAlert [1..1]`
3	`oeUpdateCrisis [0..*]`
Protocol condition(s)	
1	
Pre-condition(s)	
1	
Main post-condition(s)	
1	
Main Steps	
a	the actor `actAuthenticated` executes the `oeCreateAlert` use case
b	the actor `actCoordinator` executes the `oeCreateAlert` use case
c	the actor `actCoordinator` executes the `oeValidateAlert` use case
d	the actor `actSystem` executes the `oeChooseInformation` use case

continues in next page . . .

... Use-Case Description table continuation

e	the actor actCoordinator executes the oeUpdateCrisis use case
Steps Ordering Constraints	
1	if c then previously a or b
2	if d then previously a or b
3	if e then previously a or b
Additional Information	
none	

2.3.1.12 usergoal-ugWitnessSendFamilyNotification

USE-CASE DESCRIPTION	
Name	ugWitnessSendFamilyNotification
Scope	system
Level	usergoal
Primary actor(s)	
1	actSystem[active]
Secondary actor(s)	
1	actAuthenticated[active]
2	actCoordinator[proactive]
Goal(s) description	
Reuse	
1	oeCreateAlert [1..*]
2	oeValidateAlert [1..1]
3	oeUpdateCrisis [0..*]
Protocol condition(s)	
1	
Pre-condition(s)	
1	
Main post-condition(s)	
1	
Main Steps	
a	the actor actAuthenticated executes the oeCreateAlert use case
b	the actor actCoordinator executes the oeCreateAlert use case
c	the actor actCoordinator executes the oeValidateAlert use case
d	the actor actSystem executes the oeChooseInformation use case
e	the actor actCoordinator executes the oeUpdateCrisis use case
Steps Ordering Constraints	
1	if c then previously a or b
2	if d then previously a or b
3	if e then previously a or b
Additional Information	
none	

2.3.1.13 subfunction-oeCaptchaInvalid

Notifies the system that the supplied captcha answer is invalid

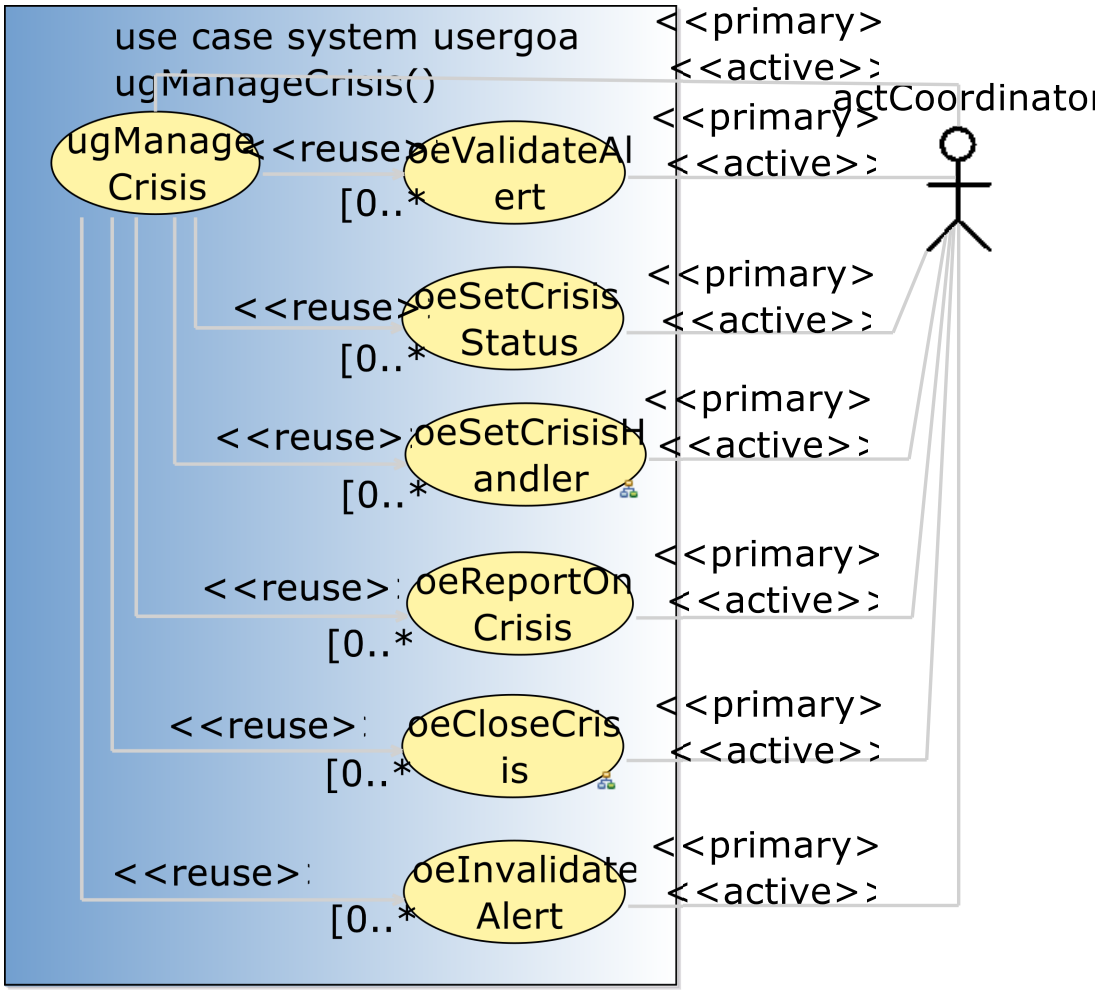


Figure 2.7: ugManageCrisis user goal use case

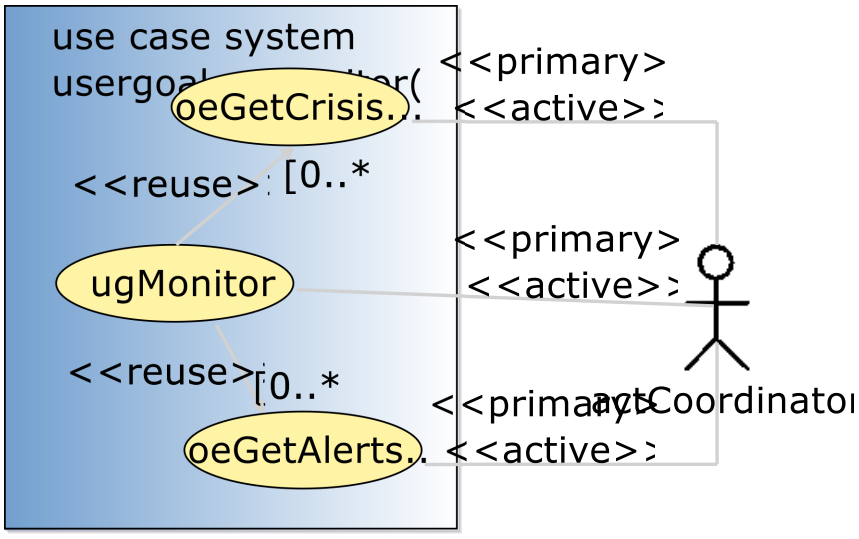


Figure 2.8: ugMonitor user goal use case

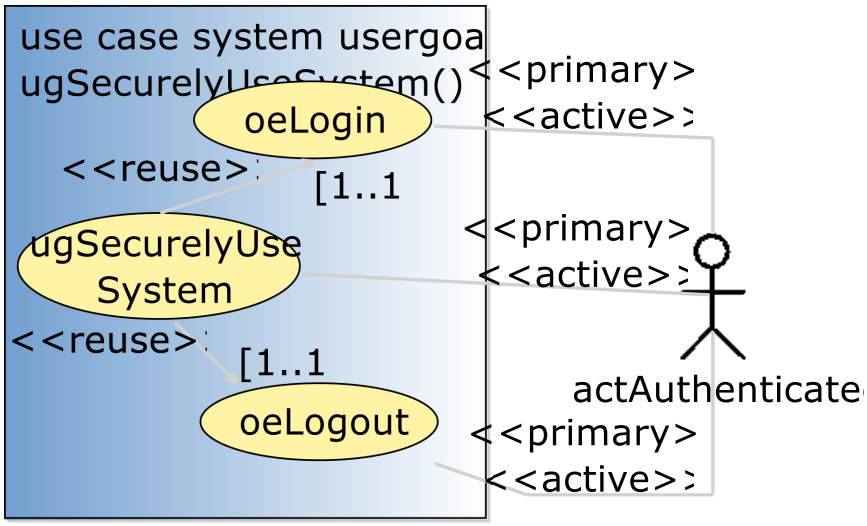


Figure 2.9: ugSecurelyUseSystem user goal use case

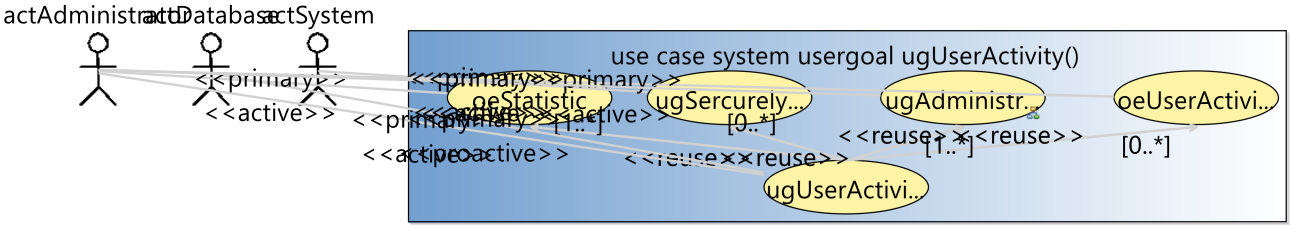


Figure 2.10: The activity of the users

Use-Case Description	
Name	oeCaptchaInvalid
Scope	system
Level	subfunction
Primary actor(s)	
1	`actCaptchaValidator[active]`
Secondary actor(s)	
1	`actMailingService[]`
2	`actAuthenticated[]`
Goal(s) description	
Notifies the system that the supplied captcha answer is invalid	
Protocol condition(s)	
1	The system must have requested the generation of a captcha test from the generation actor first and should have received a captcha test
2	The system must have submitted or forwarded an answer to the captcha test to the validation actor
Pre-condition(s)	
1	The submitted answer to the captcha test is incorrect
Main post-condition(s)	
1	The system is notified about the failure state of the submitted answer to the captcha test
2	If the requested user name failed five times in a row to log in, the user name will be blocked and a mail with instructions to unblock the user name will be send to the affected user
Additional Information	
none	

2.3.1.14 subfunction-oeCaptchaValid

Notifies the system that the supplied captcha answer is valid

Use-Case Description	
Name	oeCaptchaValid
Scope	system
Level	subfunction
Primary actor(s)	
1	`actCaptchaValidator[active]`
Secondary actor(s)	
1	`actAuthenticated[]`
Goal(s) description	
Notifies the system that the supplied captcha answer is valid	
Protocol condition(s)	
1	The system must have requested the generation of a captcha test from the generation actor first and should have received a captcha test
2	The system must have submitted or forwarded an answer to the captcha test to the validation actor
Pre-condition(s)	
1	The submitted answer to the captcha test is correct
Main post-condition(s)	

continues in next page . . .

... Use-Case Description table continuation

1	The system is notified about the success state of the submitted answer to the captcha test
Additional Information	
none	

2.3.1.15 subfunction-oeChooseInformation

Output event in which the system selects predefined alert or crisis information to be sent to the family of the identified victim

Use-Case Description	
Name	oeChooseInformation
Scope	system
Level	subfunction
Primary actor(s)	
1	`actSystem[active]`
Goal(s) description	
Output event in which the system selects predefined alert or crisis information to be sent to the family of the identified victim	
Protocol condition(s)	
1	The system has to be started and a crisis has to be created already
Pre-condition(s)	
1	The information given by the alert creator has to be correct
Main post-condition(s)	
1	The information is added to the family notification
Additional Information	
none	

2.3.1.16 subfunction-oeCreateAlert

Use-Case Description	
Name	oeCreateAlert
Scope	system
Level	subfunction
Primary actor(s)	
1	`actAuthenticated[active]`
Goal(s) description	
Protocol condition(s)	
1	
Pre-condition(s)	
1	
Main post-condition(s)	
1	
Additional Information	
none	

2.3.1.17 subfunction-oeNumberOfCrisis

An actor has been login as a Administrator to use the statistic function. So he can see the number of crises compared with the time

Use-Case Description	
Name	oeNumberOfCrisis
Scope	system
Level	subfunction
Primary actor(s)	
1	`actAdministrator[active]`
Secondary actor(s)	
1	`actDatabase[passive]`
Goal(s) description	
An actor has been login as a Administrator to use the statistic function. So he can see the number of crises compared with the time	
Protocol condition(s)	
1	The actor has been login as a administrator and he has to click on the button static.
2	The actor must be able to access the system (connected to the internet)
Pre-condition(s)	
1	The actor is not login as a administrator, so he can click the button statistic.
Main post-condition(s)	
1	if the login was successful, the actor is now identified and thus able to access the AdministrateTheSystem
2	The actor can click the button statistic and so he see the statistic
Additional Information	
none	

2.3.1.18 subfunction-oeSendCaptcha

The actor responsible for captcha generation sends a captcha test and its answer to the system

Use-Case Description	
Name	oeSendCaptcha
Scope	system
Level	subfunction
Primary actor(s)	
1	`actCaptchaGenerator[active]`
Secondary actor(s)	
1	`actAuthenticated[]`
Goal(s) description	
The actor responsible for captcha generation sends a captcha test and its answer to the system	
Protocol condition(s)	
1	the system has to be started
2	the captcha generator has to be available
Pre-condition(s)	
1	the system must have notified the actor first in order that he can generate the captcha
Main post-condition(s)	

continues in next page . . .

... Use-Case Description table continuation

1	due to the request of the system, the captcha test and its answer has been generated and sent back to the system
Additional Information	
none	

2.3.1.19 subfunction-oeSendNotification

USE-CASE DESCRIPTION	
Name	oeSendNotification
Scope	system
Level	subfunction
Primary actor(s)	
1	`actSystem[active]`
Goal(s) description	
Protocol condition(s)	
1	
Pre-condition(s)	
1	
Main post-condition(s)	
1	
Additional Information	
none	

2.3.1.20 subfunction-oeSendStatistic

Send the statistic to the system that the system send it to the administrator

USE-CASE DESCRIPTION	
Name	oeSendStatistic
Scope	system
Level	subfunction
Primary actor(s)	
1	`actSystem[active]`
Secondary actor(s)	
1	`actAdministrator[passive]`
2	`actDatabase[passive]`
Goal(s) description	
Send the statistic to the system that the system send it to the administrator	
Protocol condition(s)	
1	The actor has been login as a administrator to call the statistic so the subfunction can send the data to the system
Pre-condition(s)	
1	The administrator has call the statistic, so the function will send the information
Main post-condition(s)	
1	if the administrator click to the button statistic so the system will find the information.

continues in next page ...

... Use-Case Description table continuation

2	the Database has send back the information to the system and after to the actor.
Additional Information	
none	

2.3.1.21 subfunction-oeSetCrisisHandler

goal is to declare himself as been the handler of a crisis having the specified id.

USE-CASE DESCRIPTION	
Name	oeSetCrisisHandler
Scope	system
Level	subfunction
Parameters	
AdtCrisisID: dtCrisisID 1	
Primary actor(s)	
1	`actCoordinator[active]`
Secondary actor(s)	
1	`actCoordinator[passive]`
2	`actComCompany[passive, multiple]`
Goal(s) description	
goal is to declare himself as been the handler of a crisis having the specified id.	
Protocol condition(s)	
1	
Pre-condition(s)	
1	
Main post-condition(s)	
1	
Additional Information	
none	

Figure 2.11 shows the use case diagram for the oeSetCrisisHandler subfunction use case

2.3.1.22 subfunction-oeSollicitateCrisisHandling

the actActivator's goal is to decrease the number of unhandled crisis.

USE-CASE DESCRIPTION	
Name	oeSollicitateCrisisHandling
Scope	system
Level	subfunction
Primary actor(s)	
1	`actActivator[proactive]`
Secondary actor(s)	
1	`actCoordinator[passive, multiple]`
2	`actAdministrator[passive]`

continues in next page ...

... Use-Case Description table continuation

Goal(s) description	
the actActivator's goal is to decrease the number of unhandled crisis.	
Protocol condition(s)	
1	the iCrash system has been deployed.
2	there exist some crisis still pending and for which no solicitation has been sent to the administrator and the coordinators for more than a predefined maximum delay.
Pre-condition(s)	
1	none
Main post-condition(s)	
1	a simple text message ieMessage('There are alerts not treated since more than the defined delay. Please REACT !') is sent to the system administrator and to all the coordinators of the environment for each crisis that is known to be not handled and for which no solicitation has been sent to the administrator and the coordinators for more than a predefined maximum delay.')
2	the reminder period for the concerned crisis is initialized.

Figure 2.12 shows the use case diagram for the oeSollicitateCrisisHandling subfunction use case

2.3.1.23 subfunction-oeStatistic

Is a new button for the administrator so he can look the different statistic

Use-Case Description	
Name	oeStatistic
Scope	system
Level	subfunction
Primary actor(s)	
1	`actAdministrator[active]`
Secondary actor(s)	
1	`actSystem[passive]`
Goal(s) description	
Is a new button for the administrator so he can look the different statistic	
Protocol condition(s)	
1	The actor has been login as a administrator and he has to click on the button static.
2	The actor must be able to access the system (connected to the internet)
Pre-condition(s)	
1	The actor is not login as a administrator, so he can click the button statistic.
Main post-condition(s)	
1	if the login was successful, the actor is now identified and thus able to access the AdministrateTheSystem
2	The actor can click the button statistic and so he see the statistic
Additional Information	
none	

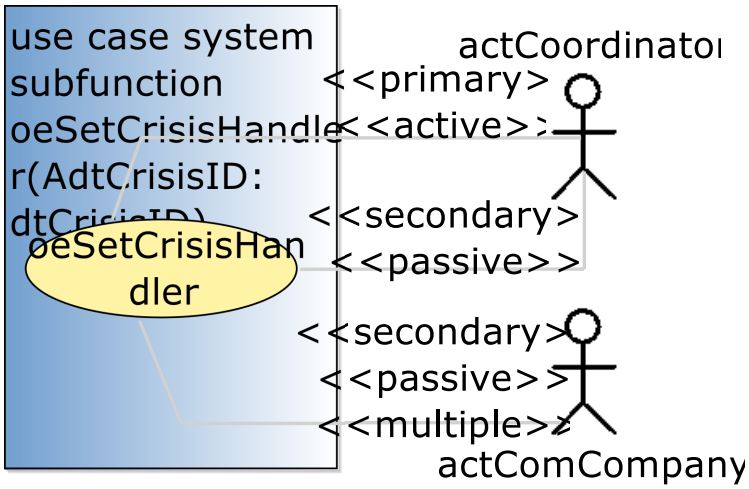


Figure 2.11: oeSetCrisisHandler subfunction use case

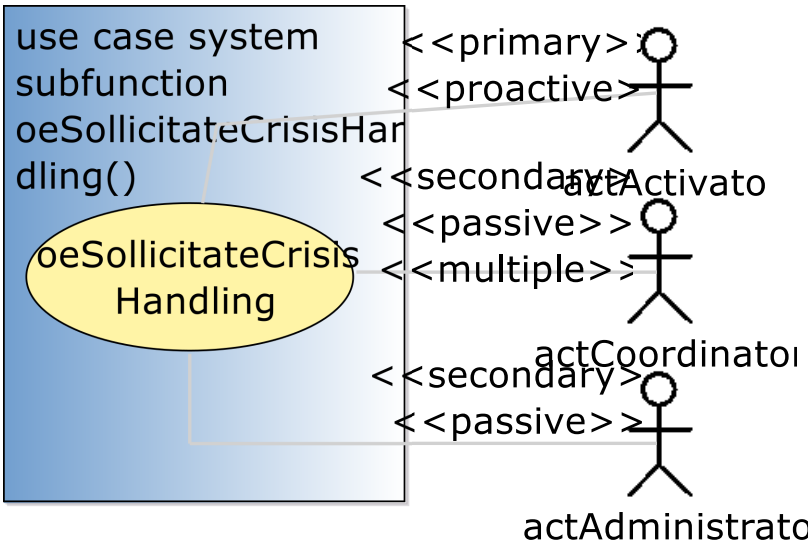


Figure 2.12: oeSollicitateCrisisHandling subfunction use case

2.3.1.24 subfunction-oeSubmitCaptcha

The actor submits his answer to a captcha test to the system for validation

Use-Case Description	
Name	oeSubmitCaptcha
Scope	system
Level	subfunction
Primary actor(s)	
1	`actAuthenticated[active]`
Secondary actor(s)	
1	`actCaptchaValidator[]`
Goal(s) description	
The actor submits his answer to a captcha test to the system for validation	
Protocol condition(s)	
1	the system has to be started
2	the actor has to be connected but not yet identified to the system
3	the system must have received first the captcha test and its answer from the actor responsible for captcha generation
Pre-condition(s)	
1	the actor receives the captcha test from the system
Main post-condition(s)	
1	the actor submitted an answer to the given captcha test back to the system
Additional Information	
none	

2.3.1.25 subfunction-oeTimeOfTypeOfCrisis

An actor has been login as a Administrator to use the statistic function. So he can see the average time for the different types of a crises

Use-Case Description	
Name	oeTimeOfTypeOfCrisis
Scope	system
Level	subfunction
Primary actor(s)	
1	`actAdministrator[active]`
Secondary actor(s)	
1	`actDatabase[passive]`
2	`actSystem[passive]`
Goal(s) description	
An actor has been login as a Administrator to use the statistic function. So he can see the average time for the different types of a crises	
Protocol condition(s)	
1	The actor has been login as a administrator and he has to click on the button static.
2	The actor must be able to access the system (connected to the internet)
Pre-condition(s)	
1	The actor is not login as a administrator, so he can click the button statistic.

continues in next page . . .

... Use-Case Description table continuation

Main post-condition(s)	
1	if the login was successful, the actor is now identified and thus able to access the AdministrateTheSystem
2	The actor can click the button statistic and so he see the statistic
Additional Information	
none	

2.3.1.26 subfunction-oeUpdateCrisis

USE-CASE DESCRIPTION	
Name	oeUpdateCrisis
Scope	system
Level	subfunction
Primary actor(s)	
1	`actCoordinator[proactive]`
Goal(s) description	
Protocol condition(s)	
1	
Pre-condition(s)	
1	
Main post-condition(s)	
1	
Additional Information	
none	

2.3.1.27 subfunction-oeUserActivityStatistic

An actor has been login as a Administrator to use the statistic function. So he can see the number of user compared with the time

USE-CASE DESCRIPTION	
Name	oeUserActivityStatistic
Scope	system
Level	subfunction
Primary actor(s)	
1	`actAdministrator[active]`
Secondary actor(s)	
1	`actDatabase[passive]`
Goal(s) description	
An actor has been login as a Administrator to use the statistic function. So he can see the number of user compared with the time	
Protocol condition(s)	
1	The actor has been login as a administrator and he has to click on the button static.
2	The actor must be able to access the system (connected to the internet)
Pre-condition(s)	

continues in next page ...

. . . Use-Case Description table continuation

1	The actor is not login as a administrator, so he can click the button statistic.
Main post-condition(s)	
1	if the login was successful, the actor is now identified and thus able to access the AdministrateTheSystem
2	The actor can click the button statistic and so he see the statistic
Additional Information	
none	

2.3.1.28 subfunction-ugSercurelyUserSystem

USE-CASE DESCRIPTION	
Name	ugSercurelyUserSystem
Scope	system
Level	subfunction
Primary actor(s)	
1	`actSystem[active]`
Goal(s) description	
Protocol condition(s)	
1	
Pre-condition(s)	
1	
Main post-condition(s)	
1	
Additional Information	
none	

2.3.2 Use Case Instance(s)

2.3.2.1 Use-Case Instance - uciSimpleAndCompletePart01:suDeployAndRun

First part of a use case instance for the summary use case `suDeployAndRun` illustrating a simple and complete interaction scenario primarily handled by an administrator in a concrete situation.

SUMMARY USE-CASE INSTANCE	
Instantiated Use Case	
suDeployAndRun	
Instance ID	
uciSimpleAndCompletePart01	
Remarks	
a	shows the system initilization and the first administrative tasks by the administrator.
b	The unique and always existing `actMsrCreator` actor instance (named here `theCreator`) requests the initialization of the system and its environment (made of one administrator identified here by `bill`), one activator actor (identified by `theClock`) and indicating that the number of communication company actor instances for the system's environment is 4 (one of them is identified here by `tango`)
c	the administrator logs in to initialize a coordinator
d	an alert is received. Time is goind one without having the coordinator handling the alert which let's the proactive actor trigger the automatic sollicitation of crisis handling.
e	this first part stops before the coordinator logs in the system.

Figure 2.13 shows the sequence diagram representing the first part of a simple and complete use case instance for the summary use case `suDeployAndRun`.

2.3.2.2 Use-Case Instance - uciSimpleAndCompletePart02:suDeployAndRun

Second part of a simple and complete use case instance for the summary use case `suDeployAndRun` illustrating a simple and complete interaction scenario primarily handled by an administrator in a concrete situation.

SUMMARY USE-CASE INSTANCE	
Instantiated Use Case	
suDeployAndRun	
Instance ID	
uciSimpleAndCompletePart02	
Remarks	
a	starts when the coordinator logs in the system until the full handling of all the existing crisis.
b	shows an instantiated case of handling of a crisis by a coordinator until its closure after reporting.

Figure 2.14 shows the sequence diagram representing the second part of a simple and complete use case instance for the summary use case `suDeployAndRun`.

Figure 2.13: uci-suDeployAndRun-uciSimpleAndComplete-Part01

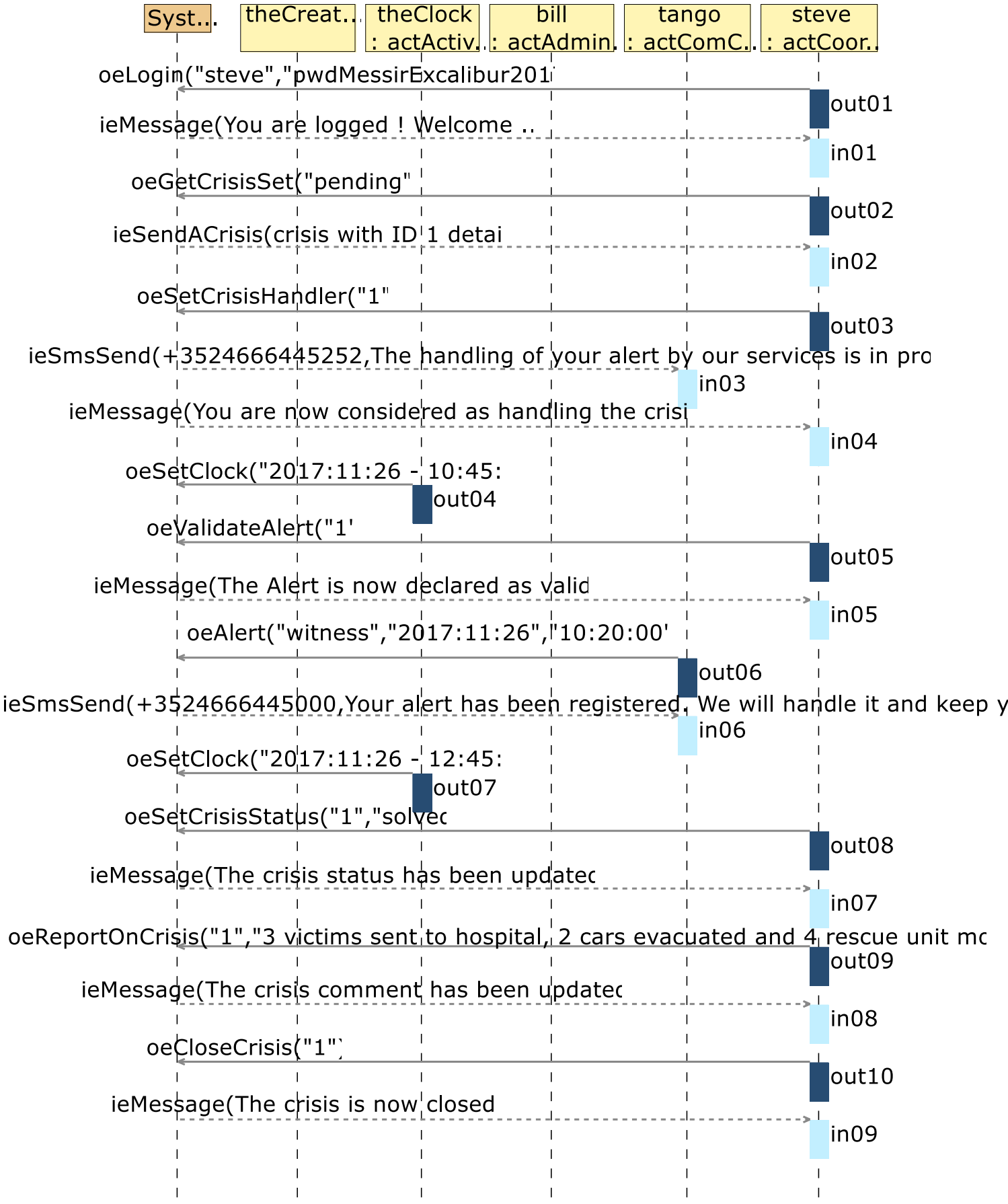


Figure 2.14: uci-suDeployAndRun-uciSimpleAndComplete-Part02 use case instance sequence diagram

2.3.2.3 Use-Case Instance - uciugStatisticAverageTypeofCrisis:ugAverageTypeofCrisis

The Administrator click the button to open the statics so the system has to call the information for the average time of the different types and send it back to the Administrator so he can see it.

USERGOAL USE-CASE INSTANCE
Instantiated Use Case ugAverageTypeofCrisis
Instance ID uciugStatisticAverageTypeofCrisis

Figure 2.15 The Administrator click the button to open the statics so the system has to call the information for the average time of the different types and send it back to the Administrator so he can see it.

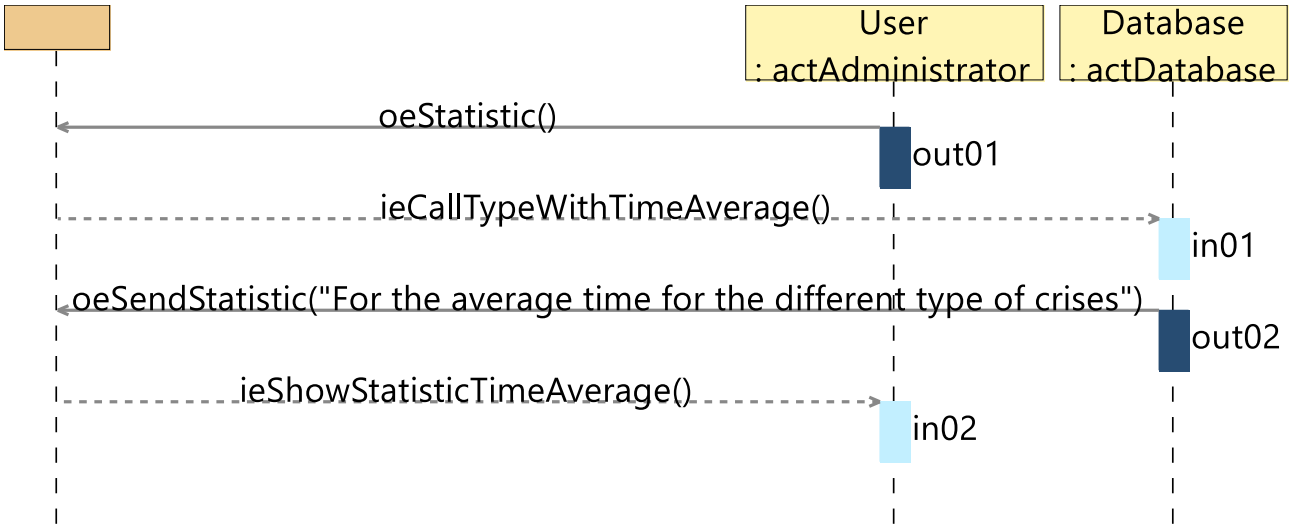


Figure 2.15: The average time of the different types

2.3.2.4 Use-Case Instance - uciugStatisticCrisisInTime:ugCrisisInTime

The administrator click the button to open the statics so the system has to call the information for the number of the crises compared with the time and send it back to the Administrator so he can see it.

USERGOAL USE-CASE INSTANCE
Instantiated Use Case ugCrisisInTime
Instance ID uciugStatisticCrisisInTime

Figure 2.16 The administrator click the button to open the statics so the system has to call the information for the number of the crises compared with the time and send it back to the Administrator so he can see it.

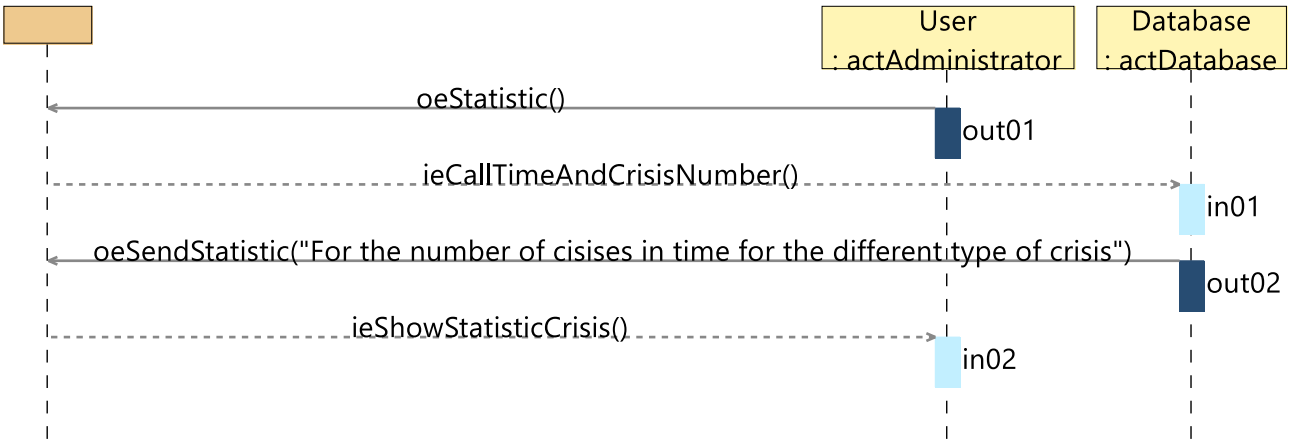


Figure 2.16: The number of the crises compared with the time

2.3.2.5 Use-Case Instance - uciugLoginCaptchaFailure:ugLogin

A failed captcha response submission after at least three failed login attempts

USERGOAL USE-CASE INSTANCE
Instantiated Use Case ugLogin
Instance ID uciugLoginCaptchaFailure

Figure 2.17 The actor tries to log in with captcha verification and incorrect credentials. The log in process will be aborted.

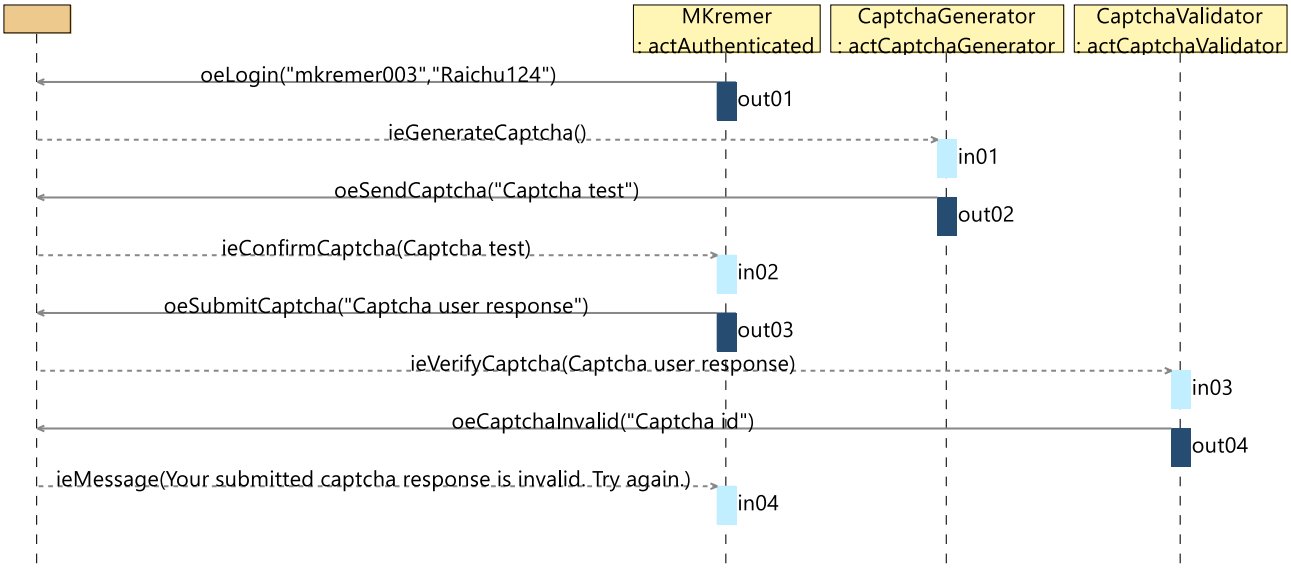


Figure 2.17: A failed login with captcha verification

2.3.2.6 Use-Case Instance - uciugLoginCaptchaSuccess:ugLogin

A successful login attempt with captcha verification

USERGOAL USE-CASE INSTANCE

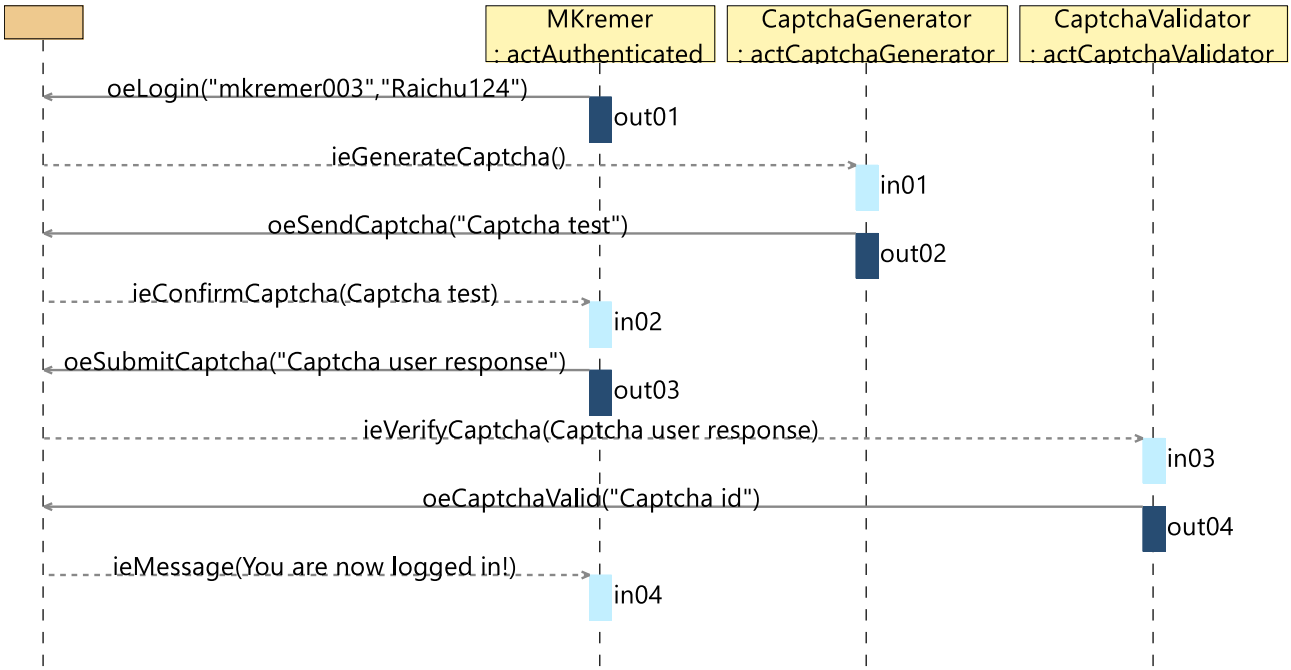


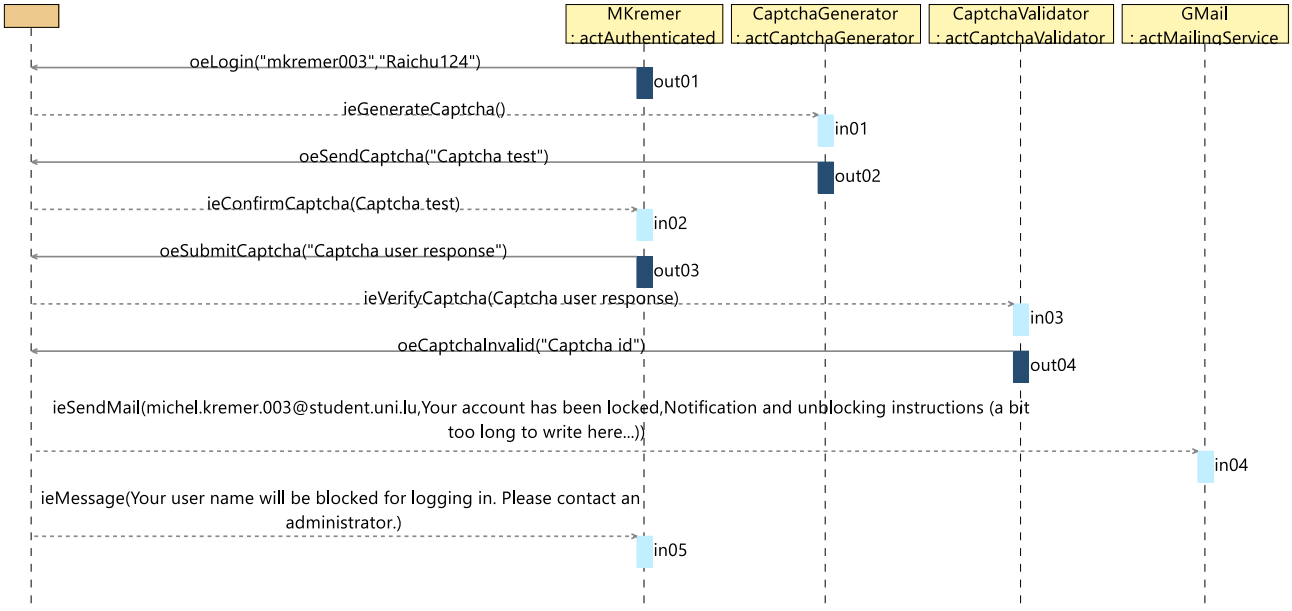
Figure 2.18: A successful login with captcha verification

2.3.2.7 Use-Case Instance - uciugLoginCaptchaToleranceExceeded:ugLogin

After three failed login attempts without and five login attempts with captcha verification, the requested login user name will be blocked for further login attempts

USERGOAL USE-CASE INSTANCE
Instantiated Use Case ugLogin
Instance ID uciugLoginCaptchaToleranceExceeded

Figure 2.19 The actor failed to log in three times without and five times with captcha verification. The login availability for the requested user name will be blocked.



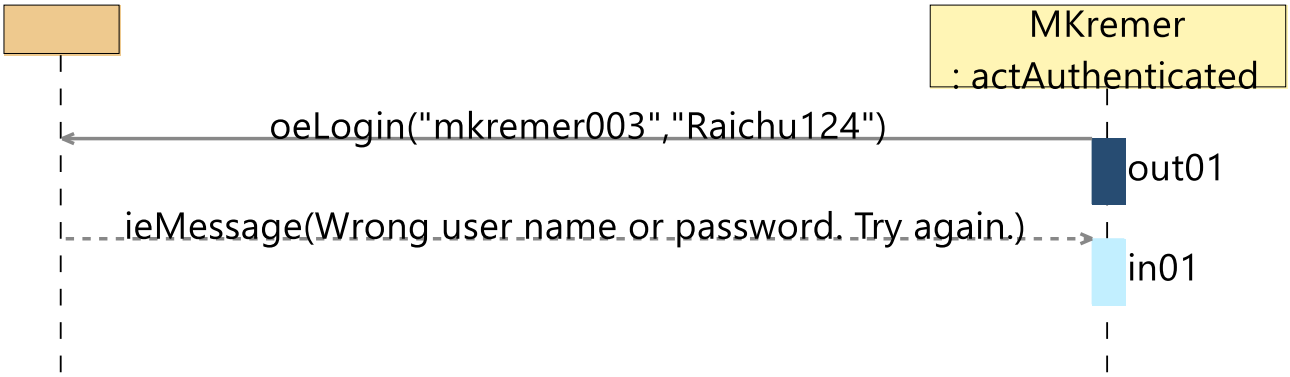


Figure 2.20: A failed login attempt

2.3.2.9 Use-Case Instance - uciugLoginRejected:ugLogin

A user tried to log in with a user name which is blocked by the system (because of many erroneous attempts to log in in a row). The login attempt will be rejected and the user will be notified.

USERGOAL USE-CASE INSTANCE
Instantiated Use Case ugLogin
Instance ID uciugLoginRejected

Figure 2.21 A user has tried to log in with a user name who has been blocked by the system from any further login attempts

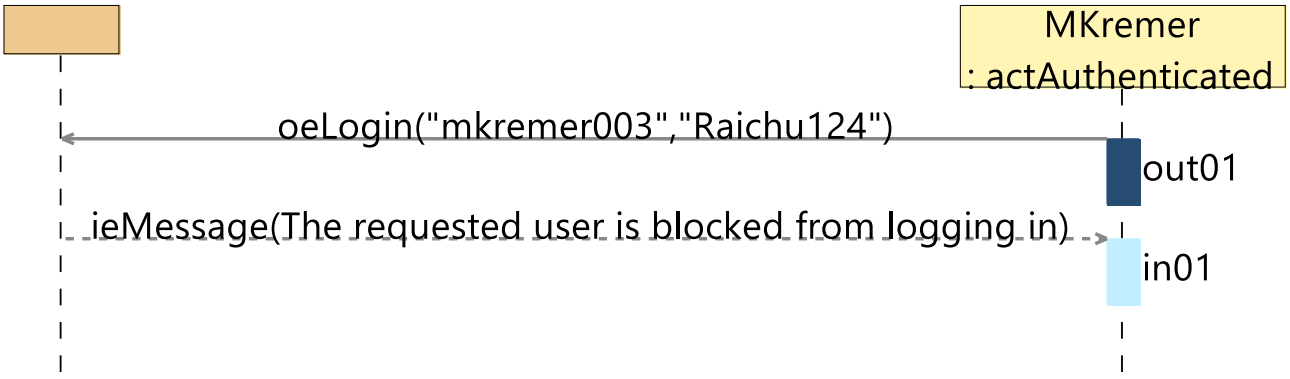


Figure 2.21: A rejected login attempt

2.3.2.10 Use-Case Instance - uciugLoginSuccess:ugLogin

A successful login attempt without captcha verification

USERGOAL USE-CASE INSTANCE
Instantiated Use Case ugLogin
Instance ID uciugLoginSuccess

. . . usergoal Use-Case Instance table continuation

ugSecurelyUseSystem
Instance ID
uciugSecurelyUseSystem

Figure 2.23

2.3.2.12 Use-Case Instance - uciugUserActivity:ugUserActivity

The actor administrator will open the statics the activity of the users,there he can find out how many users are active at any time. Also the abstract user System give the information

USERGOAL USE-CASE INSTANCE
Instantiated Use Case
ugUserActivity
Instance ID
uciugUserActivity

Figure 2.24 The administrator click the button to open the statics so the system has to call the information for the number of the user compared with the time and send it back to the Administrator so he can see it.

2.3.2.13 Use-Case Instance - uciugVictimSendFamilyNotification:ugVictimSendFamilyNotificatio

The authenticated Victim creates an alert in which he can choose to sent a notification to his family with a personal commentary. The system sends the notification. The coordinator creates a crisis for the alert and a new notification is sent with every update of the crisis.

USERGOAL USE-CASE INSTANCE
Instantiated Use Case
ugVictimSendFamilyNotification
Instance ID
uciugVictimSendFamilyNotification

2.3.2.14 Use-Case Instance - uciugWitnessSendFamilyNotification:ugWitnessSendFamilyNotificat

The authenticated Witness creates an alert in which he can identify the victim by name and surname. The system sends the notification. The coordinator creates a crisis for the alert and a new notification is sent with every update of the crisis.

USERGOAL USE-CASE INSTANCE
Instantiated Use Case
ugWitnessSendFamilyNotification
Instance ID
uciugWitnessSendFamilyNotification

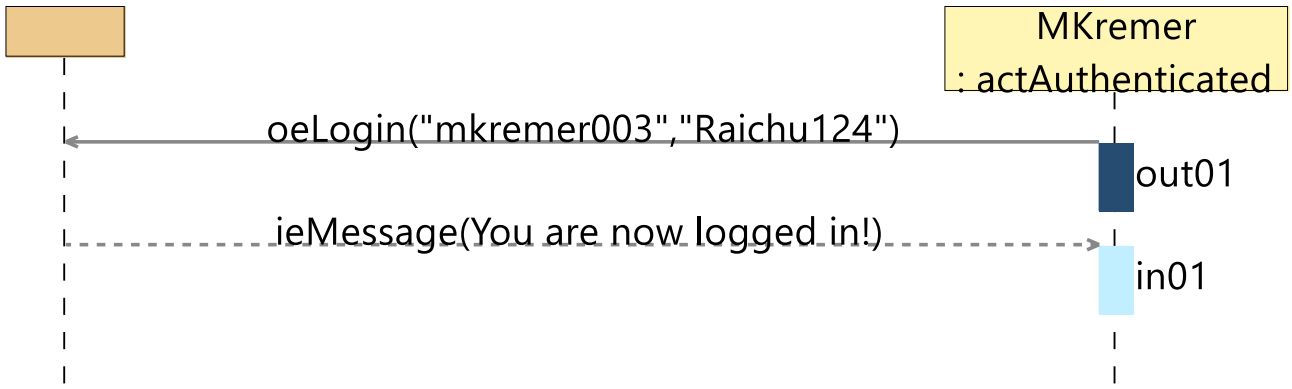


Figure 2.22: A successful login attempt

Figure 2.23:

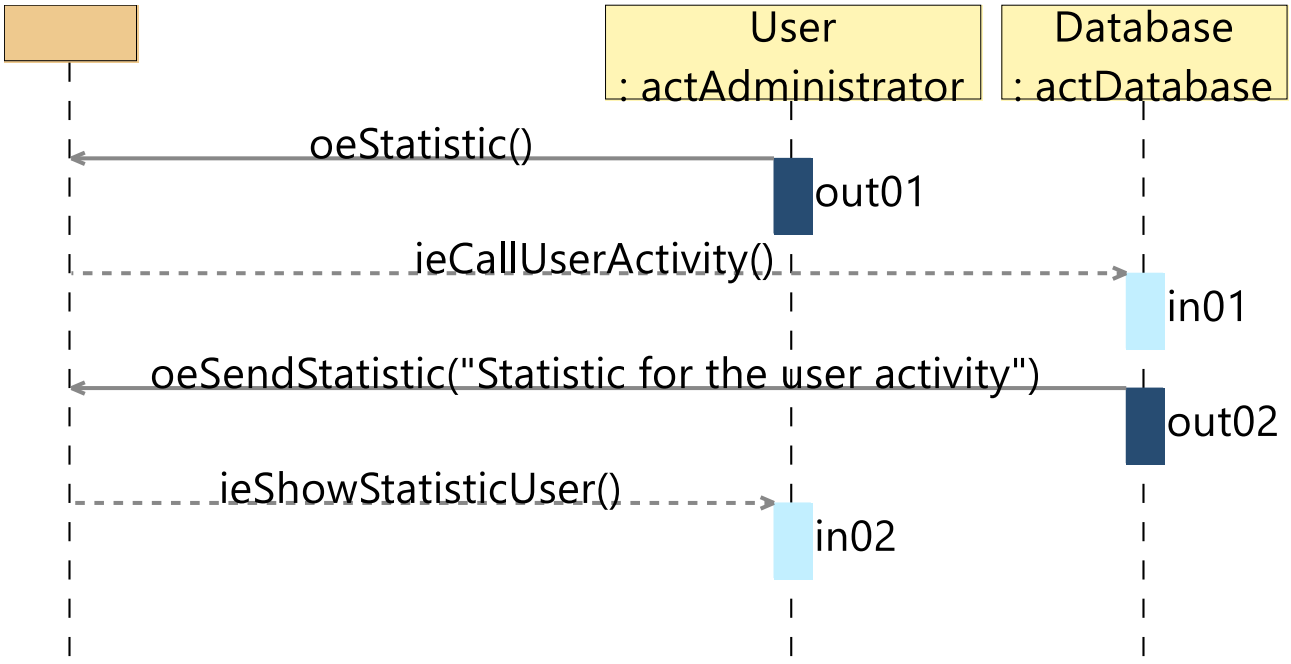


Figure 2.24: The number of the user compared with the time

Chapter 3

Environment Model

We provide below the view(s) defined for the Messir environment model (cf. [?]) of the system.

3.1 Local view 01

Figure 3.1 shows the local view giving the second part of the environment model of the system in term of its state class, actors with their input and output interfaces and all related associations.

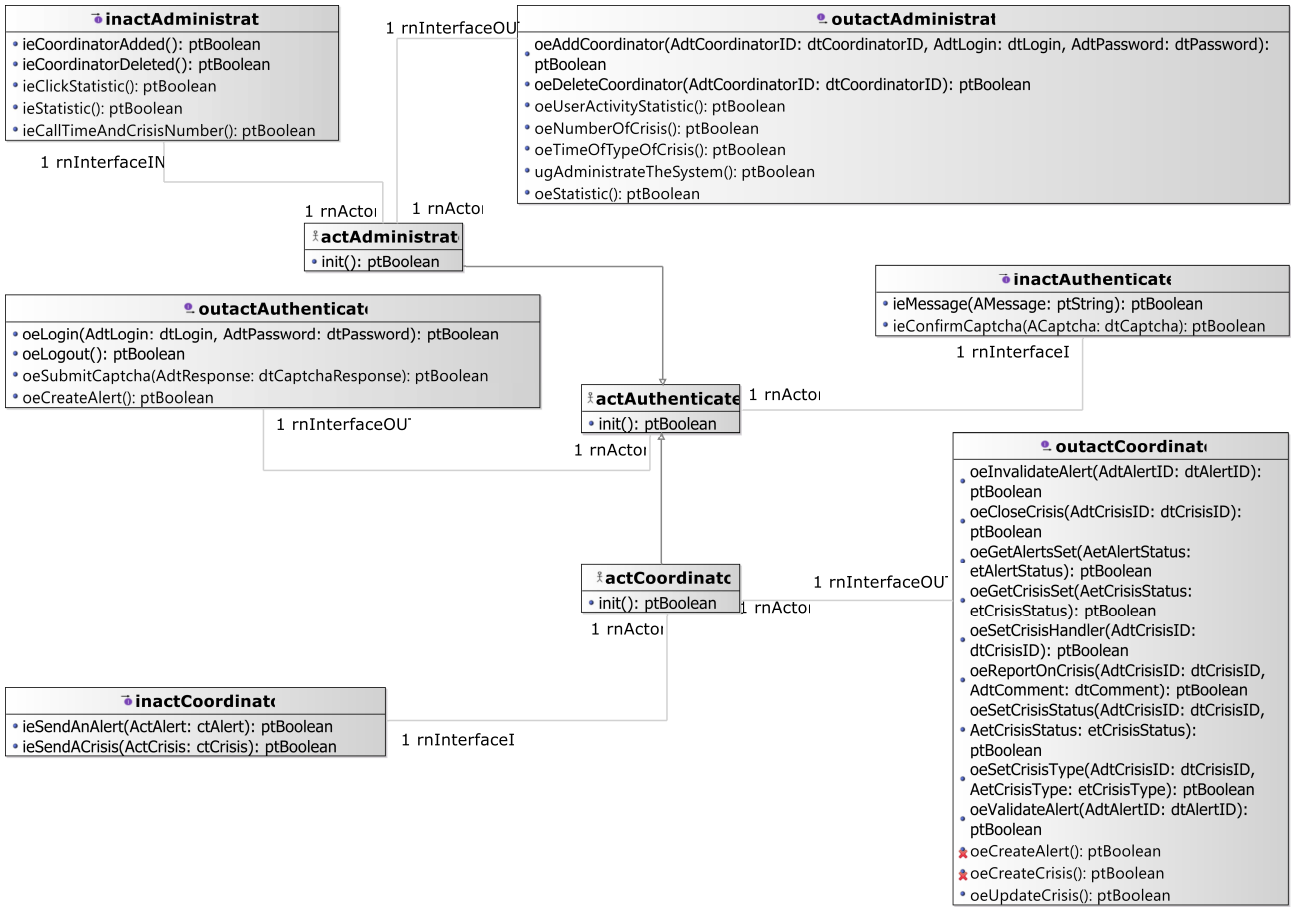


Figure 3.1: Environment Model - Local View 01. environment model local view - Part 1.

3.2 Local view 02

Figure 3.2 shows the local view giving the second part the environment model of the system in term of its state class, actors with their input and output interfaces and all related associations.

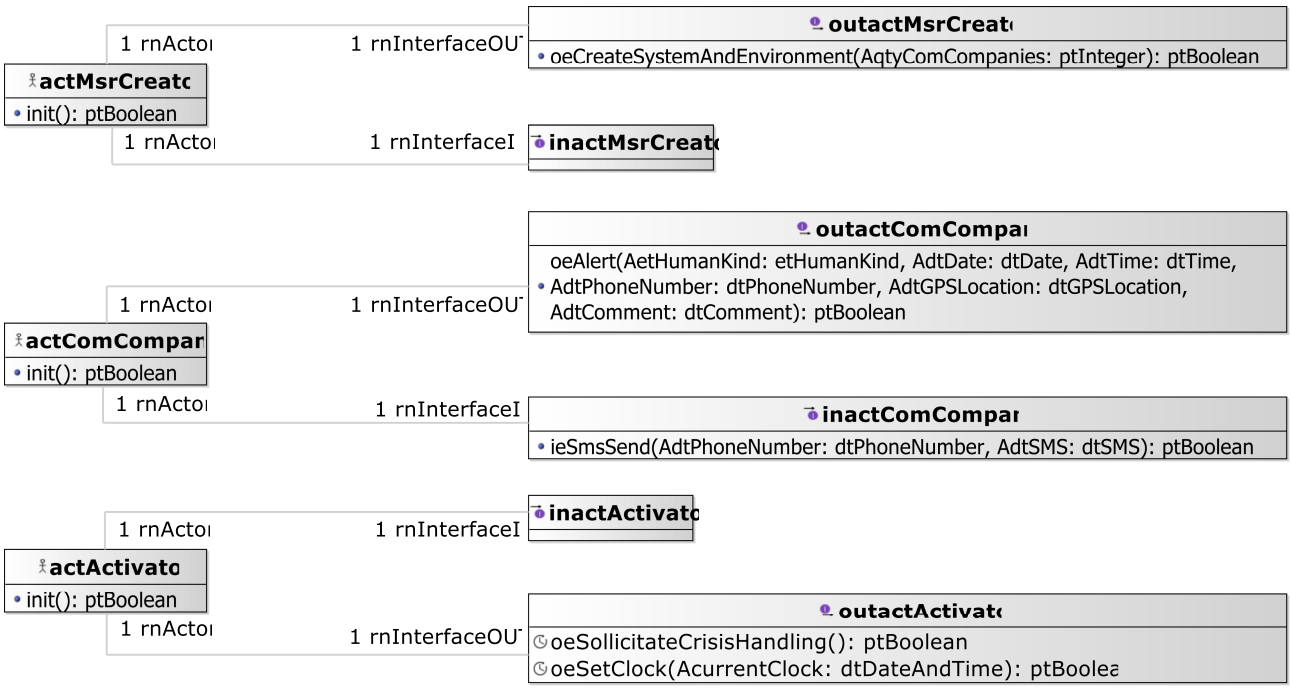


Figure 3.2: Environment Model - Local View 02. environment model local view - Part 2.

3.3 Local view 03

Figure 3.3 shows the local view for the administrator actor and interfaces

3.4 Local view 04

Figure 3.4 shows the local view for the coordinator actor and interfaces

3.5 Local view 05

Figure 3.5 shows the local view for the authenticated actor and interfaces

3.6 Local view 08

Figure 3.6 The actor responsible for captcha generation

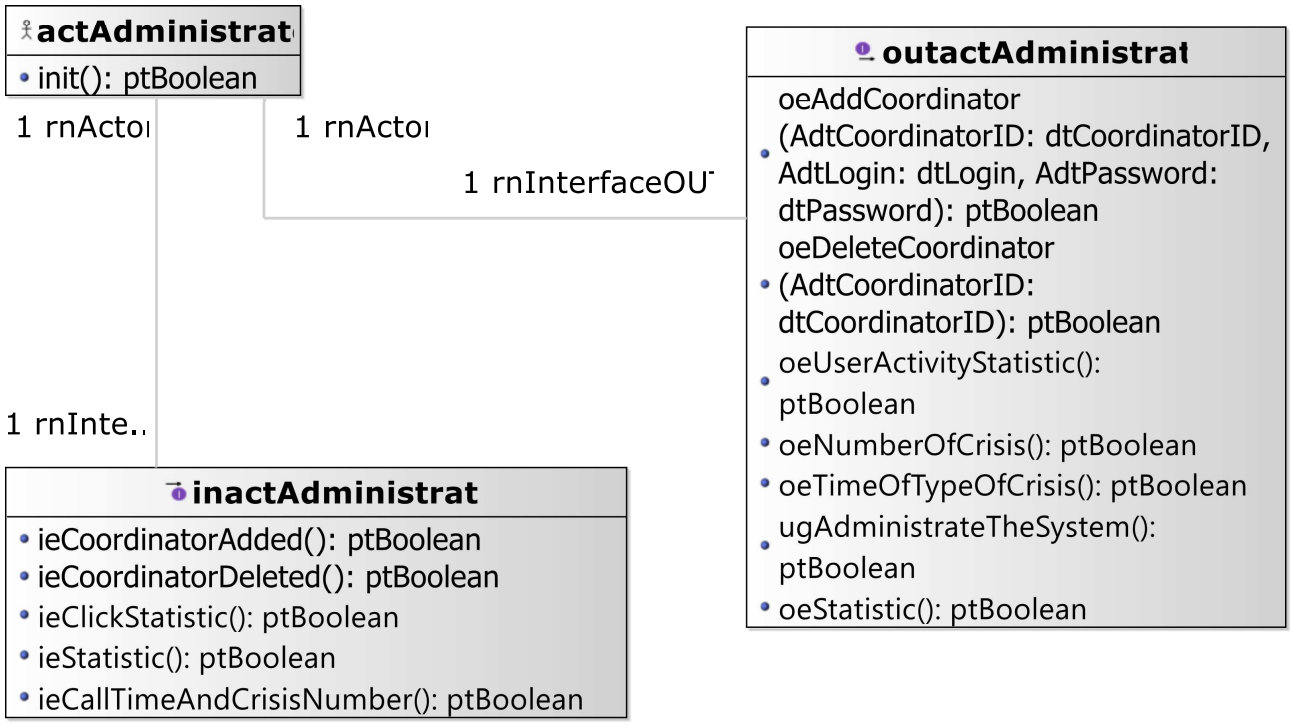


Figure 3.3: Environment Model - Local View 03. administrator actor environment model view.

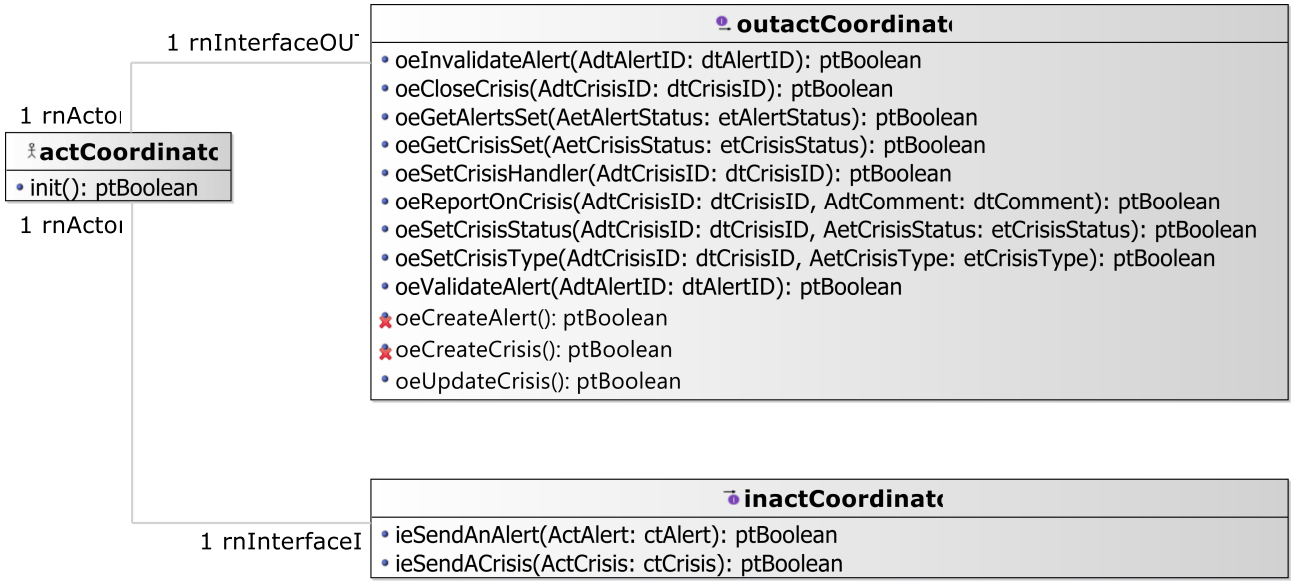


Figure 3.4: Environment Model - Local View 04. coordinator actor environment model view.

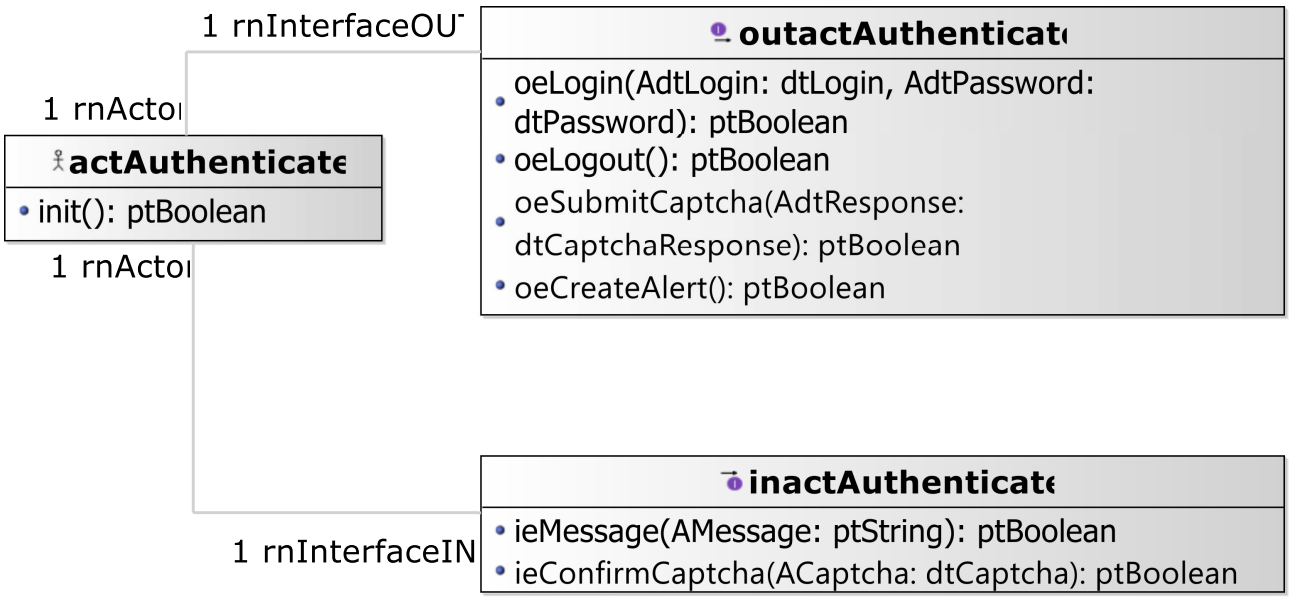


Figure 3.5: Environment Model - Local View 05. authenticated actor environment model local view.

Figure 3.6: Environment Model - Local View 08. The captcha generator.

3.7 Local view 09

Figure 3.7 The actor responsible to validate answers to a captcha test

Figure 3.7: Environment Model - Local View 09. The captcha answer validator.

3.8 Local view 10

Figure 3.8

Figure 3.8: Environment Model - Local View 10. .

3.9 Local view 11

Figure 3.9 The actor responsible to send e-mails

Figure 3.9: Environment Model - Local View 11. E-mail service.

3.10 Local view 12

Figure 3.10

3.11 Global view 01

Figure 3.10: Environment Model - Local View 12. .

Figure 3.11 shows a global view for all actors with their relationships with ctState

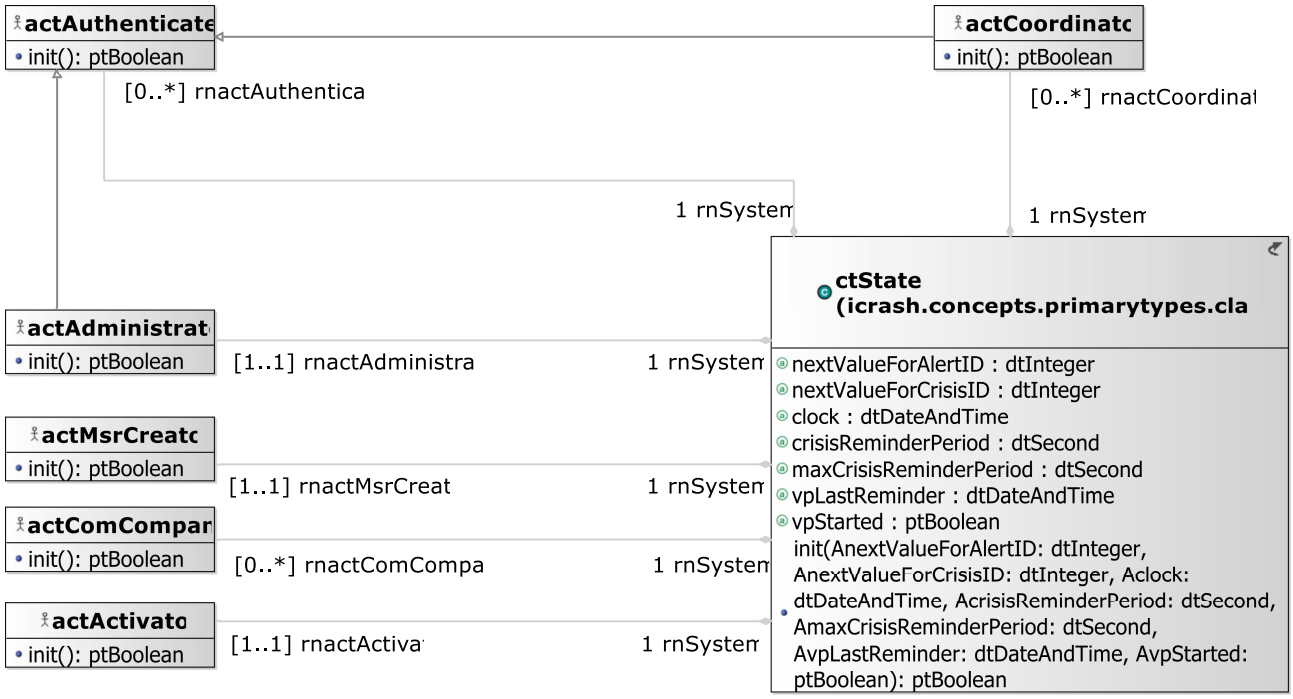


Figure 3.11: Environment Model - Global View 01. em-gv-01 environment model global view.

3.12 Actors and Interfaces Descriptions

We provide for the given views the description of the actors together with their associated input and output interface descriptions.

3.12.1 `actActivator` Actor

Actor	
actActivator	
represents a logical actor for time automatic message sending based on system's or environment status.	
OutputInterfaces	
OUT 1	**`[proactive] oeSollicitateCrisisHandling():ptBoolean`**
	used to avoid crisis to stay too long in an not handled status.
OUT 2	**`[proactive] oeSetClock(AcurrentClock:dtDateAndTime):ptBoolean`**
	used to update the system's time

3.12.2 `actAdministrator` Actor

Actor
actAdministrator
represents an actor responsible of administration tasks for the *iCrash* system.

continues in next page . . .

. . . Actor table continuation

Extends	
icrash.environment.actAuthenticated	
OutputInterfaces	
OUT 1	**oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID, AdtLogin:dtLogin, AdtPassword:dtPassword):ptBoolean** sent to add a new coordinator in the system's post state and environment's post state.
OUT 2	**oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID):ptBoolean** sent to delete an existing coordinator in the system's post state and environment's post state.
InputInterfaces	
IN 1	**ieCoordinatorAdded():ptBoolean** its reception confirms the creation of the requested coodinator.
IN 2	**ieCoordinatorDeleted():ptBoolean** its reception confirms the deletion of the requested coodinator.
IN 3	**ieClickStatistic():ptBoolean**
IN 4	**ieStatistic():ptBoolean**
IN 5	**ieCallTimeAndCrisisNumber():ptBoolean**

3.12.3 `actAuthenticated` Actor

ACTOR	
actAuthenticated abstract actor providing reusable input and output interfaces for actors that need to authenticate themselves.	
OutputInterfaces	
OUT 1	**oeLogin(AdtLogin:dtLogin, AdtPassword:dtPassword):ptBoolean** sent to request authorization to request access secured system operations.
OUT 2	**oeLogout():ptBoolean** sent to end the secured access to specific system operations.
OUT 3	**oeSubmitCaptcha(AdtResponse:dtCaptchaResponse):ptBoolean** sent to submit an answer to a previously given captcha test
InputInterfaces	
IN 1	**ieMessage(AMessage:ptString):ptBoolean** allows for receiving general textual messages.
IN 2	**ieConfirmCaptcha(ACaptcha:dtCaptcha):ptBoolean** The request of the system to the user to field a captcha test

3.12.4 `actCaptchaGenerator` Actor

ACTOR	
actCaptchaGenerator Actor providing a randomly generated captcha test to hedge a users login process	
OutputInterfaces	

continues in next page . . .

. . . Actor table continuation

OUT 1	**oeSendCaptcha(AdtCaptcha:dtCaptcha):ptBoolean** The response by the actor which provides a captcha test to the system
InputInterfaces	
IN 1	**ieGenerateCaptcha():ptBoolean** The request to the actor to generate and provide a captcha test
IN 2	**ieValidateCaptcha(AResponse:dtCaptchaResponse):ptBoolean** The request to the actor to validate a response to a captcha test

3.12.5 `actCaptchaValidator` Actor

ACTOR	
actCaptchaValidator Actor responsible for validating a captcha test	
OutputInterfaces	
OUT 1	**oeCaptchaInvalid(AdtCaptchaId:ptInteger):ptBoolean** Returns an answer to the system to notify that the supplied captcha was invalid
OUT 2	**oeCaptchaValid(AdtCaptchaId:ptInteger):ptBoolean** Returns an answer to the system to notify that the supplied captcha was valid
InputInterfaces	
IN 1	**ieVerifyCaptcha(AdtCaptchaResponse:dtCaptchaResponse):ptBoolean** Submits a captcha response to the actor to be verified

3.12.6 `actComCompany` Actor

ACTOR	
actComCompany represents the communication company stakeholder ensuring the input/ouput of textual messages with humans having communicaiton devices.	
OutputInterfaces	
OUT 1	**oeAlert(AetHumanKind:etHumanKind, AdtDate:dtDate, AdtTime:dtTime, AdtPhoneNumber:dtPhoneNumber, AdtGPSLocation:dtGPSLocation, AdtComment:dtComment):ptBoolean** sent to alert of a potential crisis situation.
InputInterfaces	
IN 1	**ieSmsSend(AdtPhoneNumber:dtPhoneNumber, AdtSMS:dtSMS):ptBoolean** allows for receiving textual messages to be dispatched to the communication company customers having the provided phone number.

3.12.7 `actCoordinator` Actor

ACTOR
actCoordinator represents actor responsible of handling one or several crisis for the *iCrash* system.
Extends
icrash.environment.actAuthenticated

continues in next page . . .

... Actor table continuation

OutputInterfaces	
OUT 1	**oeInvalidateAlert(AdtAlertID:dtAlertID):ptBoolean** sent to indicate that an alert should be considered as closed.
OUT 2	**oeCloseCrisis(AdtCrisisID:dtCrisisID):ptBoolean** sent to indicate that a crisis should be considered as closed.
OUT 3	**oeGetAlertsSet(AetAlertStatus:etAlertStatus):ptBoolean** sent to request all the ctAlert instances having a specific status.
OUT 4	**oeGetCrisisSet(AetCrisisStatus:etCrisisStatus):ptBoolean** sent to request all the ctCrisis instances having a specific status.
OUT 5	**oeSetCrisisHandler(AdtCrisisID:dtCrisisID):ptBoolean** sent to declare himself as been the handler of a crisis having the specified id.
OUT 6	**oeReportOnCrisis(AdtCrisisID:dtCrisisID, AdtComment:dtComment):ptBoolea** sent to update the textual information available for a specific handled crisis.
OUT 7	**oeSetCrisisStatus(AdtCrisisID:dtCrisisID, AetCrisisStatus:etCrisisStatu** sent to define the handling status of a specific crisis.
OUT 8	**oeSetCrisisType(AdtCrisisID:dtCrisisID, AetCrisisType:etCrisisType):ptB** sent to define the gravity type of a specific crisis.
OUT 9	**oeValidateAlert(AdtAlertID:dtAlertID):ptBoolean** sent to indicate that a specific alert is not a fake.
InputInterfaces	
IN 1	**ieSendAnAlert(ActAlert:ctAlert):ptBoolean** allows for receiving a requested ctAlert instance.
IN 2	**ieSendACrisis(ActCrisis:ctCrisis):ptBoolean** allows for receiving a requested ctCrisis instance.

3.12.8 `actDatabase` Actor

ACTOR	
actDatabase	
InputInterfaces	
IN 1	**ieCallTimeAndCrisisNumber():ptBoolean**
IN 2	**ieCallUserActivity():ptBoolean**
IN 3	**ieCallTypeWithTimeAverage():ptBoolean**
IN 4	**oeSendStatistic():ptBoolean**
IN 5	**oeStatistic():ptBoolean**

3.12.9 `actMailingService` Actor

ACTOR
actMailingService

continues in next page ...

. . . Actor table continuation

An actor who is responsible for sending mails to actors who are registered in the system with an e-mail address
InputInterfaces
IN 1 **ieSendMail(AAddress:ptString, ATitle:ptString, AContent:ptString):ptBoolean** Sends an e-mail to a given e-mail address

3.12.10 `actMsrCreator` Actor

ACTOR
actMsrCreator Represents the creator stakeholder in charge of state and environment initialization.
OutputInterfaces
OUT 1 **oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger):ptBoolean** sent to request the initialization of the system's class instances and the environment actors instances.

3.12.11 `actSystem` Actor

ACTOR
actSystem
OutputInterfaces
OUT 1 **ugSercurelyUserSystem():ptBoolean**
OUT 2 **oeChooseInformation():ptBoolean**
OUT 3 **oeSendNotification():ptBoolean**
OUT 4 **oeSendStatistic():ptBoolean**
InputInterfaces
IN 1 **ieCallTimeAndCrisisNumber():ptBoolean**
IN 2 **ieCallUserActivity():ptBoolean**
IN 3 **ieCallTypeWithTimeAverage():ptBoolean**

Chapter 4

Concept Model

4.1 PrimaryTypes-Classes

4.1.1 Local view 01

Figure 4.1 shows the local view on all the primary types class types.

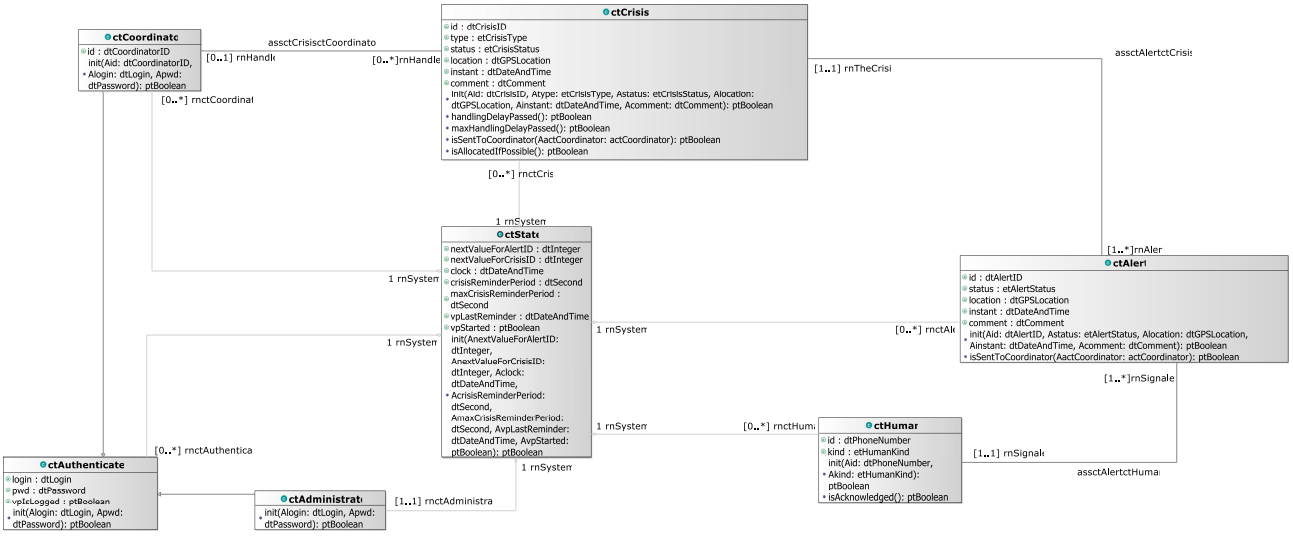


Figure 4.1: Concept Model - PrimaryTypes-Classes local view 01. Local view of all the primary types class types .

4.1.2 Local view 02

Figure 4.2 shows the local view of the ctState primary type class type.

4.1.3 Local view 03

Figure 4.3 shows the local view of the ctAlert primary type class type.

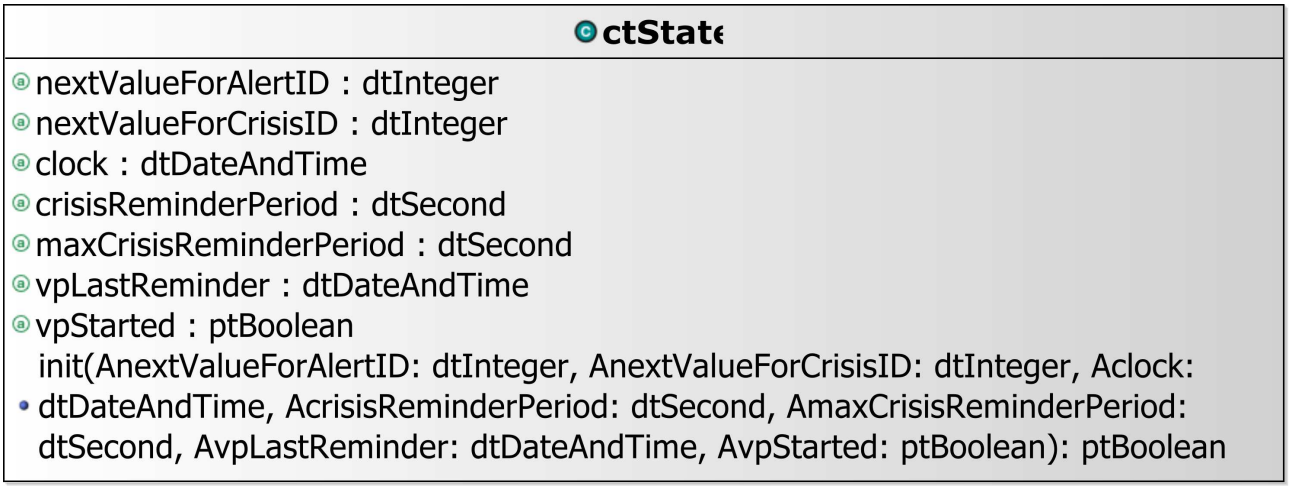


Figure 4.2: Concept Model - PrimaryTypes-Classes local view 02. local view of the ctState primary type.

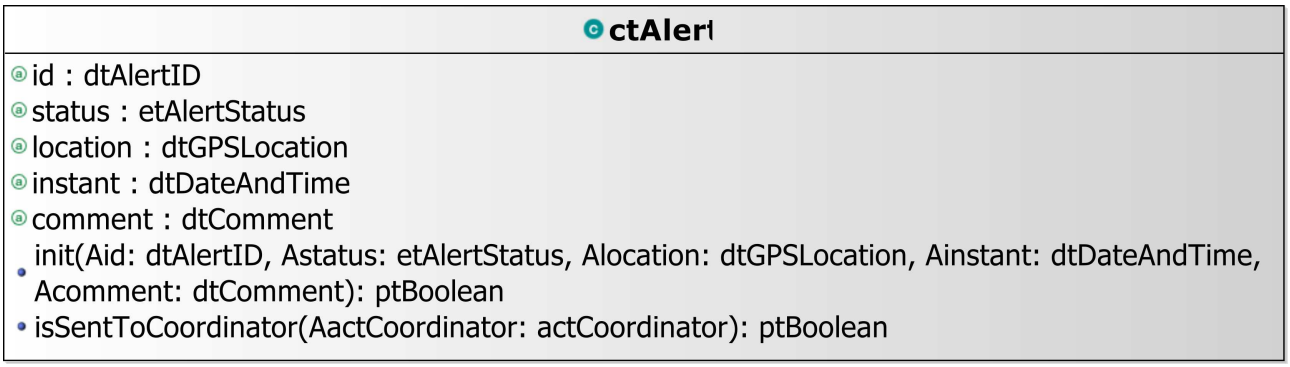


Figure 4.3: Concept Model - PrimaryTypes-Classes local view 03. local view of the ctAlert primary type.

4.1.4 Local view 04

Figure 4.4 shows the local view of the ctCrisis primary type class type.

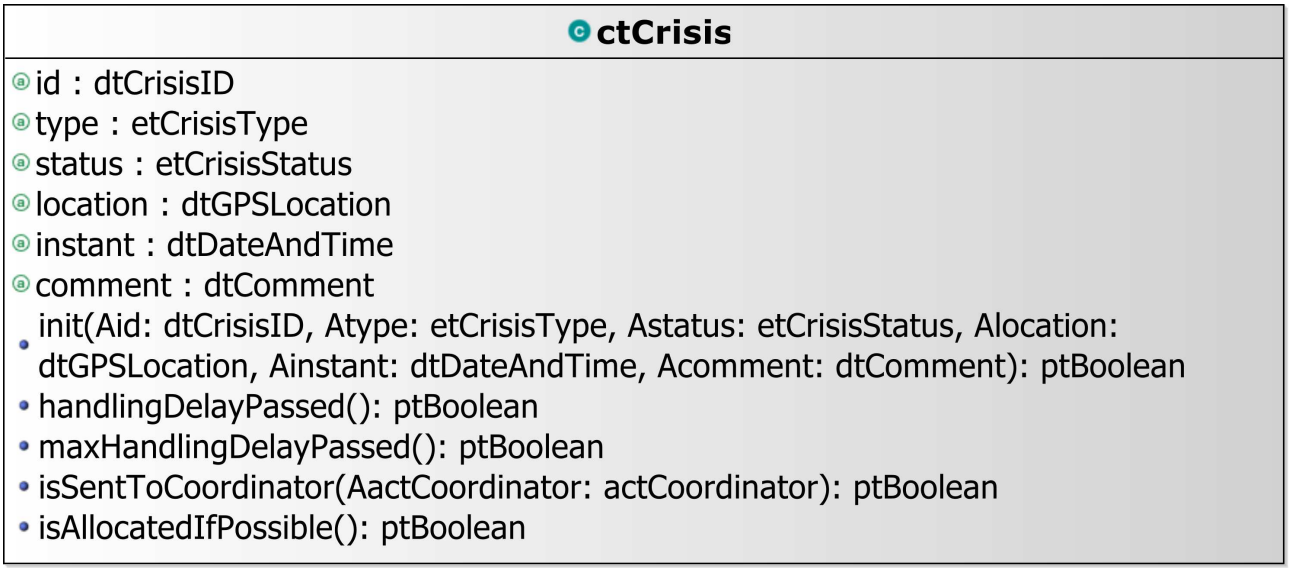


Figure 4.4: Concept Model - PrimaryTypes-Classes local view 04. local view of the ctCrisis primary type.

4.1.5 Global view 01

Figure 4.5 shows the global view on primary types class types showing the association(s) types with the actor classes of the environment model.

4.2 PrimaryTypes-Datatypes

4.2.1 Local view 06

Figure 4.6

4.2.2 Global view 01

Figure 4.7 shows a global view on the *iCrash* primary types datatype types.

4.3 SecondaryTypes-Datatypes

4.3.1 Local view 01

Figure 4.8 shows the local view of the secondary types datatype types.

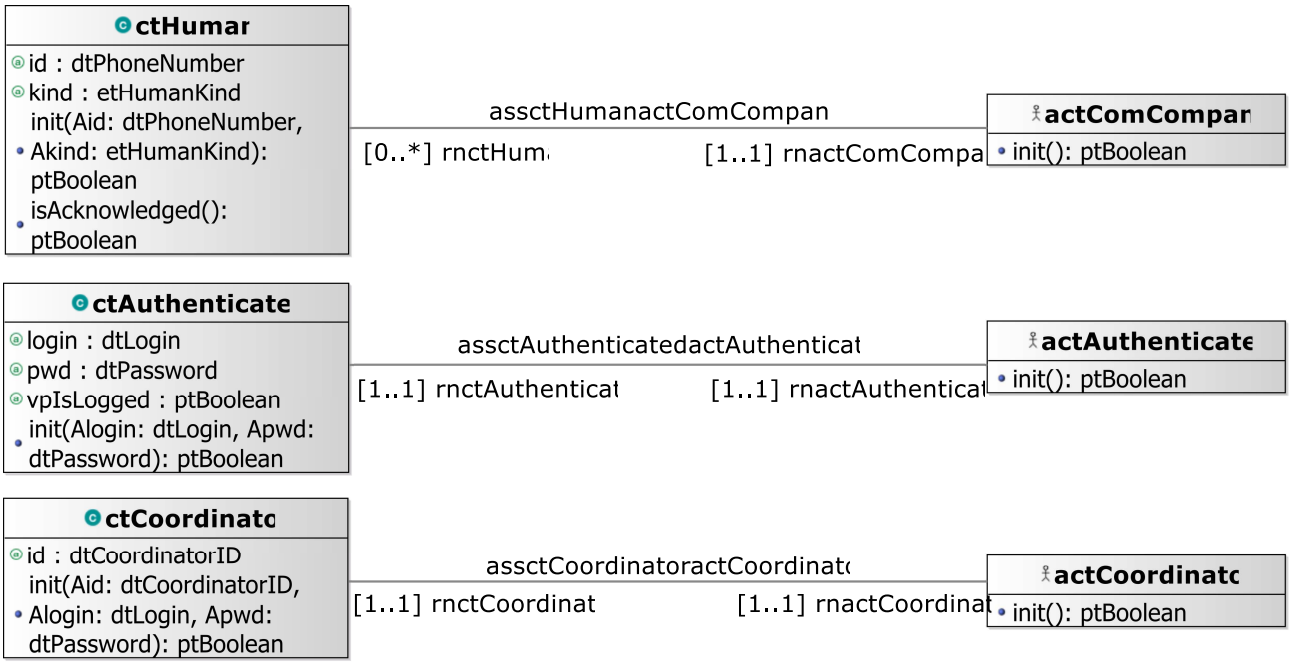


Figure 4.5: Concept Model - PrimaryTypes-Classes global view 01. Primary types class types global view - cm-pt-ct-gv-01 .

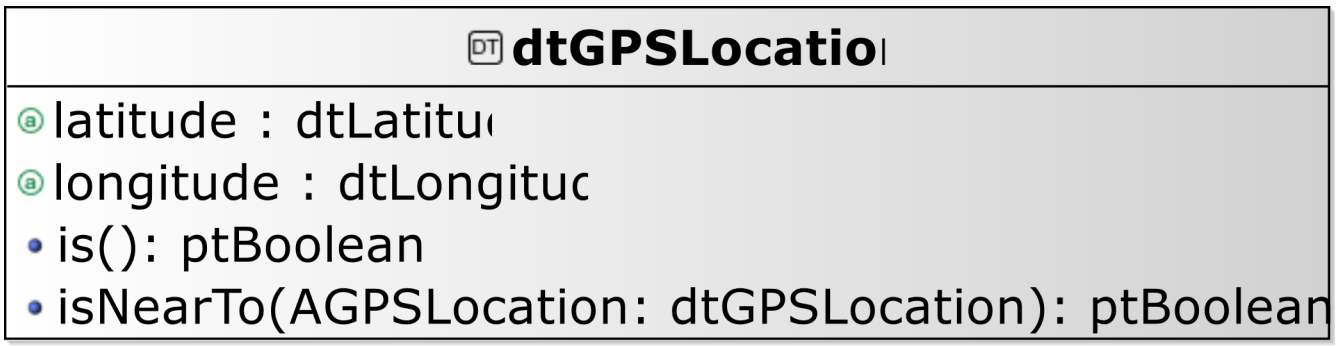


Figure 4.6: Concept Model - PrimaryTypes-Datatypes local view 06. .

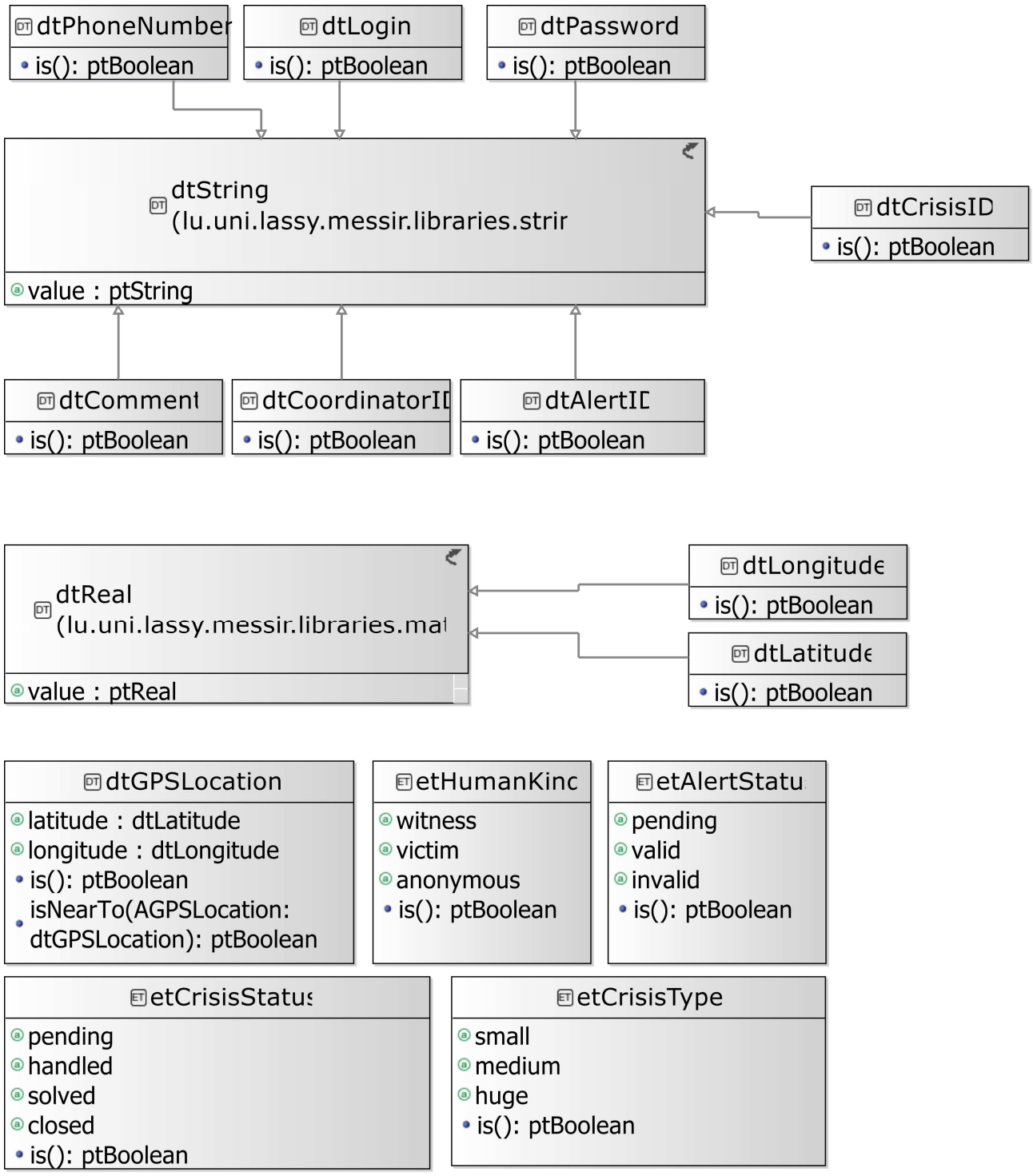


Figure 4.7: Concept Model - PrimaryTypes-Datatypes global view 01. global view of primary types datatype types - cm-pt-dt-gv-01 .

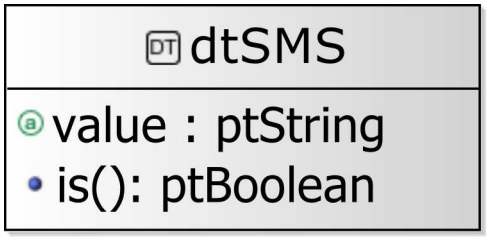


Figure 4.8: Concept Model - SecondaryTypes-Datatypes local view 01. Local view of the secondary types datatype types.

4.4 Concept Model Types Descriptions

This section provides the textual descriptions of all the types defined in the concept model and that can be part of the graphical views provided.

4.4.1 Primary types - Class types descriptions

The table below is providing comments on the graphical views given for the class types of the primary types. Type logical operations are precisely specified in the operation model.

CLASSES	
ctAdministrator	
used to caracterize internally the entity that is responsible of administrating the *iCrash* system.	
extends	icrash.concepts.primarytypes.classes.ctAuthenticated
operation	**init(Alogin:dtLogin, Apwd:dtPassword):ptBoolean** used to initialize the current object as a new instance of the ctAdministrator type.
ctAlert	
Used to model crisis alerts sent by any human having communication capability using communication companies belonging to the system's environment	
attribute	**comment: dtComment** a textual description providing unstructured information on the alert.
attribute	**id: dtAlertID** the alert unique identification information.
attribute	**instant: dtDateAndTime** the date and time at which the alert notification has been sent.
attribute	**location: dtGPSLocation** the position of the alert provided by the space-based satellite navigation system used by the human using the communication company to inform the *iCrash* system of a crisis.
attribute	**status: etAlertStatus** the alert validation status
operation	**init(Aid:dtAlertID, Astatus:etAlertStatus, Alocation:dtGPSLocation, Ainstant:dtDateAndTime, Acomment:dtComment):ptBoolean** used to initialize the current object as a new instance of the ctAlert type.
operation	**isSentToCoordinator(AactCoordinator:actCoordinator):ptBoolean** used to provide a given coordinator with current alert information.

continues in next page . . .

. . . Classes table continuation

ctAuthenticated	
used to model system's representation about actors that need to authenticate to access some specific functionalities.	
attribute	**login: dtLogin** an identifier for authentication.
attribute	**pwd: dtPassword** a key for authentication.
attribute	**vpIsLogged: ptBoolean** used to determine the access status.
operation	**init(Alogin:dtLogin, Apwd:dtPassword):ptBoolean** used to initialize the current object as a new instance of the ctAuthenticated type.
ctCoordinator	
used to model system's representation about the actors that have the responsibility to handle alerts and crisis.	
extends	icrash.concepts.primarytypes.classes.ctAuthenticated
attribute	**id: dtCoordinatorID** a unique identification information.
operation	**init(Aid:dtCoordinatorID, Alogin:dtLogin, Apwd:dtPassword):ptBoolean** used to initialize the current object as a new instance of the ctCoordinator type.
ctCrisis	
Used to model crisis that are infered from the reception of at least one alert message. Crisis aer entities that are handled by the *iCrash* system.	
attribute	**comment: dtComment** a textual description providing unstructured information on the crisis handling.
attribute	**id: dtCrisisID** the crisis unique identification information.
attribute	**instant: dtDateAndTime** the date and time at which the first related alert notification has been sent.
attribute	**location: dtGPSLocation** the position of the crisis equal by the one of the first alert received and associated to the crisis.
attribute	**status: etCrisisStatus** the crisis handling status.
attribute	**type: etCrisisType** an indication of the gravity of the crisis.
operation	**handlingDelayPassed():ptBoolean** used to determine if the crisis stood too longly in a pending status since last reminder.
operation	**init(Aid:dtCrisisID, Atype:etCrisisType, Astatus:etCrisisStatus, Alocation:dtGPSLocation, Ainstant:dtDateAndTime, Acomment:dtComment):ptBoolean** used to initialize the current object as a new instance of the ctAlert type.
operation	**isAllocatedIfPossible():ptBoolean** used to allocate a crisis to a coordinator if any or to alert the administrator of crisis waiting to be handled.
operation	**isSentToCoordinator(AactCoordinator:actCoordinator):ptBoolean** used to provide a given coordinator with current crisis information.
operation	**maxHandlingDelayPassed():ptBoolean**

continues in next page . . .

... Classes table continuation

	used to determine if the crisis stood too longly in a pending status since its creation.
ctHuman	
used to model system's representation about the indirect actors that has alerted of potential crisis.	
attribute	**id: dtPhoneNumber** the number of the communication device used to send an alert to *iCrash* system.
attribute	**kind: etHumanKind** role with respect to the alert notified.
operation	**init(Aid:dtPhoneNumber, Akind:etHumanKind):ptBoolean** init: used to initialize the current object as a new instance of the ctHuman type.
ctState	
used to model the system. Each system specified using Messir must include a ctState class for which there is only one instance at any state of the abstract machine after creation.	
attribute	**clock: dtDateAndTime** used to represent the system local time.
attribute	**crisisReminderPeriod: dtSecond** used to define the delay between two reminders after which a reminder must be sent to the administrator and to the known coordinators to encourage them to handle the crisis.
attribute	**maxCrisisReminderPeriod: dtSecond** used to define the maximum delay after which the crisis is ramdomly allocated to a coordinator if any or an alert message is sent to the administrator in order to encourage him to add coordinators.
attribute	**nextValueForAlertID: dtInteger** nextValueForAlertID: dtInteger: used to associate each alert declared with a unique idenitification value.
attribute	**nextValueForCrisisID: dtInteger** used to associate each crisis declared with a unique idenitification value.
attribute	**vpLastReminder: dtDateAndTime** date and time of the last reminder.
attribute	**vpStarted: ptBoolean** used to avoid reacting to an actor message if the system is not started (i.e. oeCreateSystemAndEnvironment not executed).
operation	**init(AnextValueForAlertID:dtInteger, AnextValueForCrisisID:dtIntege** **Aclock:dtDateAndTime, AcrisisReminderPeriod:dtSecond,** **AmaxCrisisReminderPeriod:dtSecond, AvpLastReminder:dtDateAndTime,** **AvpStarted:ptBoolean):ptBoolean** used to initialize the current object as a new instance of the ctState type.

4.4.2 Primary types - Datatypes types descriptions

The table below is providing comments on the graphical views given for the datatype types of the primary types.

DATATYPES	
dtAlertID	
A string used to identify alerts.	
extends	dtString
operation	**is():ptBoolean**

continues in next page ...

. . . Datatypes table continuation

	used to determine which strings are considered as valid alert identifiers.
dtCaptcha	
Contains the actual representation of an image based captcha test	
attribute	**id: ptInteger**
	The internal id of this captcha test. This is used for the actCaptchaGenerator to identify the captcha test in case of a response.
attribute	**question: ptString**
	The human readable question related to this captcha test, needed by a human to be able to solve the captcha test
dtCaptchaImage	
The actual representation of an image related to a captcha test. The inheritance from dtString allows to store the binary data of the image as bytes in string format.	
extends	dtString
attribute	**height: ptInteger**
	Represents the height of the image in pixels
attribute	**width: ptInteger**
	Represents the width of the image in pixels
dtCaptchaResponse	
Contains the users response to a given captcha test	
attribute	**id: ptInteger**
	The internal id which qualifies the related captcha test
attribute	**response: ptString**
	The response data given by the user
dtComment	
a datatype made of a string value used to receive,store and send textual information about crisis and alerts.	
extends	dtString
operation	**is():ptBoolean**
	used to determine which strings are considered as valid comments.
dtCoordinatorID	
A string used to identify coordinators.	
extends	dtString
operation	**is():ptBoolean**
	used to determine which strings are considered as valid coordinators identifiers.
dtCrisisID	
A string used to identify crisis.	
extends	dtString
operation	**is():ptBoolean**
	used to determine which strings are considered as valid crisis identifiers.
dtGPSLocation	
used to define coordinates of geograpical positions on earth. It is defined a couple made of a latitude and a longitude.	
attribute	**latitude: dtLatitude**
	for the latitude part of the coordinate.
attribute	**longitude: dtLongitude**
	for the longitude part of the coordinate.
operation	**is():ptBoolean**
	used to determine which couples are considered as valid dtGPSLocation values.

continues in next page . . .

... Datatypes table continuation

operation	**isNearTo(AGPSLocation:dtGPSLocation):ptBoolean** used to determine if locations are considered enough close to be treated as equivalent in the application domain context.
dtLatitude	
used to define a latitude value of a geograpical positions on earth.	
extends	dtReal
operation	**is():ptBoolean** used to determine which strings are considered as valid dtLatitude.
dtLogin	
a login string used to authentify an *iCrash* user	
extends	dtString
operation	**is():ptBoolean** used to determine which strings are considered as valid dtLogin.
dtLongitude	
used to define a longitude value of a geograpical positions on earth.	
extends	dtReal
operation	**is():ptBoolean** used to determine which strings are considered as valid dtLongitude.
dtPassword	
a password string used to authentify an *iCrash* user	
extends	dtString
operation	**is():ptBoolean** used to determine which strings are considered as valid dtPassword.
dtPhoneNumber	
a string used to store the phone number from the human declaring the crisis or the alert.	
extends	dtString
operation	**is():ptBoolean** used to determine which strings are considered as valid dtPhoneNumber.
dtStatisticCrisisinTime	
Statistic representing a number of crises compared with a specific timespan	
attribute	**number: ptInteger** The amount of crises
attribute	**time: dtTime** The related timestamp
dtStatisticTypeCrisis	
Show what the attribute for the static the average time of the different crises	
attribute	**time: dtTime** The related timestamp representing the date
attribute	**typeC: ptString** The type of the crisis
dtStatisticUserActivity	
Represents a statistic of a number of users in relation to a specific timespan	
attribute	**number: ptInteger** The amount of involved users
attribute	**time: dtTime** The related timestamp

Enumerations	
etAlertStatus	
this type is used to indicate the different validation status of an alert.	
operation	**is():ptBoolean**
	used to determine which litteral belongs to the enumeration.
etCrisisStatus	
this type is used to indicate the different handling status of a crisis.	
operation	**is():ptBoolean**
	used to determine which litteral belongs to the enumeration.
etCrisisType	
this type is used to indicate the different types of a crisis.	
operation	**is():ptBoolean**
	used to determine which litteral belongs to the enumeration.
etHumanKind	
this type is used to indicate the kind of human that informs about a car crash crisis.	
operation	**is():ptBoolean**
	used to determine which litteral belongs to the enumeration.

4.4.3 Primary types - Association types descriptions

The table below is providing comments on the association types of the primary types.

Undirected associations
assctAlertctCrisis
a crisis is related to one or more alerts as the alerts judged to concern all the same crisis due to their location. An alert alerts exactly one crisis.
assctAlertctHuman
alerts are notified by human through the communication company. We need to keep an internal representation of those human to allow for communication of alert handling.
assctAuthenticatedactAuthenticated
mainly used to determine if the login request of an authenticated actor can be granted based on the given credentials and the registered ones.
assctCoordinatoractCoordinator
frequent messages must be sent to coordinator especially in relation to crisis they handle.
assctCrisisctCoordinator
at any point in time we need to know if a coordinator is handling existing crisis or not.
assctHumanactComCompany
in order to communicate with humans who informed about potential crisis, we need to record the communication company to use to send them messages.

4.4.4 Primary types - Aggregation types descriptions

There are no aggregation types for the primary types.

4.4.4.1 Primary types - Composition types descriptions

There are no composition types for the primary types.

4.4.5 Secondary types - Class types descriptions

There are no elements in this category in the system analysed.

4.4.6 Secondary types - Datatypes types descriptions

The table below is providing comments on the graphical views given for the datatype types of the secondary types.

DATATYPES	
dtSMS	
a datatype made of a string value used to send textual information to human mobile devices.	
attribute	**`value: ptString`** the textual information.
operation	**`is():ptBoolean`** used to determine which strings are considered as valid comments.

4.4.7 Secondary types - Association types descriptions

There are no association types for the secondary types.

4.4.8 Secondary types - Aggregation types descriptions

There are no aggregation types for the secondary types.

4.4.9 Secondary types - Composition types descriptions

There are no composition types for the secondary types.

Chapter 5

Operation Model

This section contains the operation schemes of each operation defined in either an actor, its output interface, in a primary or secondary type (class, datatype or enumeration types). The Messir OCL code listing is joined to the comment table.

5.1 Environment - Out Interface Operation Scheme for actActivator

5.1.1 Operation Model for oeSetClock

The `oeSetClock` operation has the following properties:

Operation	
oeSetClock[proactive]	
An active message used to statically set the date and time information in the system's state.	
Parameters	
1	**AcurrentClock: dtDateAndTime** the date and time to be considered as the actual one.
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is supposed to be created and initialized and the provided date and time value is greater than the one known by the system.
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
PostF 1	the ctState instance post-state is updated to have its clock attribute equal to the given date and time.
Post-Condition (protocol)	
PostP 1	none

The listing 5.1 provides the Messir (MCL-oriented) specification of the operation.

```
1
2 /* Pre Protocol:*/
3 preP{let TheSystem: ctState in
```

```
4   let AvpStarted: ptBoolean in
5
6  /* PreP01 */
7   self.rnActor.rnSystem = TheSystem
8   and self.rnActor.rnSystem.vpStarted = AvpStarted
9   and AvpStarted = true
10  and TheSystem.clock.lt(AcurrentClock)}
11
12 /* Pre Functional:*/
13 preF{true}
14
15 /* Post Functional:*/
16 postF{let TheSystem: ctState in
17  self.rnActor.rnSystem = TheSystem
18
19 /* PostF01 */
20  and TheSystem@post.clock = AcurrentClock}
21
22 /* Post Protocol:*/
23 postP{ true}
```

Listing 5.1: Messir (MCL-oriented) specification of the operation *oeSetClock*.

5.1.2 Operation Model for oeSollicitateCrisisHandling

The `oeSollicitateCrisisHandling` operation has the following properties:

OPERATION	
oeSollicitateCrisisHandling[proactive] A proactive message (message of a pro-active actor with no parameter triggered automatically if the pre protocol condition is true) used to avoid crisis to stay too long in an not handled status.	
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	there exist some crisis that are in pending status and for which the duration between the current ctState clock information and the last reminder is greater than the crisis reminder period duration.
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
PostF 1	if there exist coordinators and crisis who stood in a not handled status more than the maximum allowed time then those crisis are randomly allocated to the existing coordinators.
PostF 2	for all other crisis who stood too longly in a not handled status but not more than the maximum delay allowed then a reminder message is sent to the administrator and all coordinator actors of the environment to sollicitate handling of those crisis.
Post-Condition (protocol)	
PostP 1	the value of the last reminder known by the system at post state is the system's clock value.

The listing 5.2 provides the Messir (MCL-oriented) specification of the operation.

```
1
2 /* Pre Protocol:*/
```

```
preP{let TheSystem: ctState in
 let AvpStarted: ptBoolean in
 let ColctCrisisToHandle:
    Bag(ctCrisis) in

 self.rnActor.rnSystem = TheSystem

/* PreP01 */
 and TheSystem.vpStarted

/* PreP02 */
 and TheSystem.rnctCrisis->select(handlingDelayPassed())
   = ColctCrisisToHandle
 and ColctCrisisToHandle->size().geq(1)}

/* Pre Functional:*/
preF{true}

/* Post Functional:*/
postF{let TheSystem: ctState in
 let AMessageForCrisisHandlers: dtComment in
 let ColctCrisisToAllocateIfPossible:Bag(ctCrisis) in

 self.rnActor.rnSystem = TheSystem
/* PostF01 */
 and TheSystem.rnctCrisis->select(maxHandlingDelayPassed())
   = ColctCrisisToAllocateIfPossible
 and ColctCrisisToAllocateIfPossible->forAll(isAllocatedIfPossible())

 /* PostF02 */
 and TheSystem.rnctCrisis->select(handlingDelayPassed())
 = ColctCrisisToHandle

 and ColctCrisisToHandle->msrColSubtract(ColctCrisisToAllocateIfPossible)
   = ColctCrisisToRemind

 and if (ColctCrisisToRemind->size().geq(1))
   then (AMessageForCrisisHandlers.value
      ='There are alerts pending since more than the defined delay. Please REACT !'
      and TheSystem.rnactAdministrator.
        rnInterfaceIN^ieMessage(AMessageForCrisisHandlers)
        and TheSystem.rnactCoordinator
          ->forAll(rnInterfaceIN^ieMessage(AMessageForCrisisHandlers))
      )
   else true
   endif}

/* Post Protocol:*/
postP{ let TheSystem: ctState in
 let TheClock: dtDateAndTime in

 self.rnActor.rnSystem = TheSystem
 and TheSystem.clock = TheClock
 and TheSystem@post.vpLastReminder = TheClock}
```

Listing 5.2: Messiр (MCL-oriented) specification of the operation *oeSollicitateCrisisHandling*.

Figure 5.1 shows concept model elements in the scope of the oeSollicitateCrisisHandling operation

5.2 Environment - Out Interface Operation Scheme for actAdministrator

5.2.1 Operation Model for oeAddCoordinator

The `oeAddCoordinator` operation has the following properties:

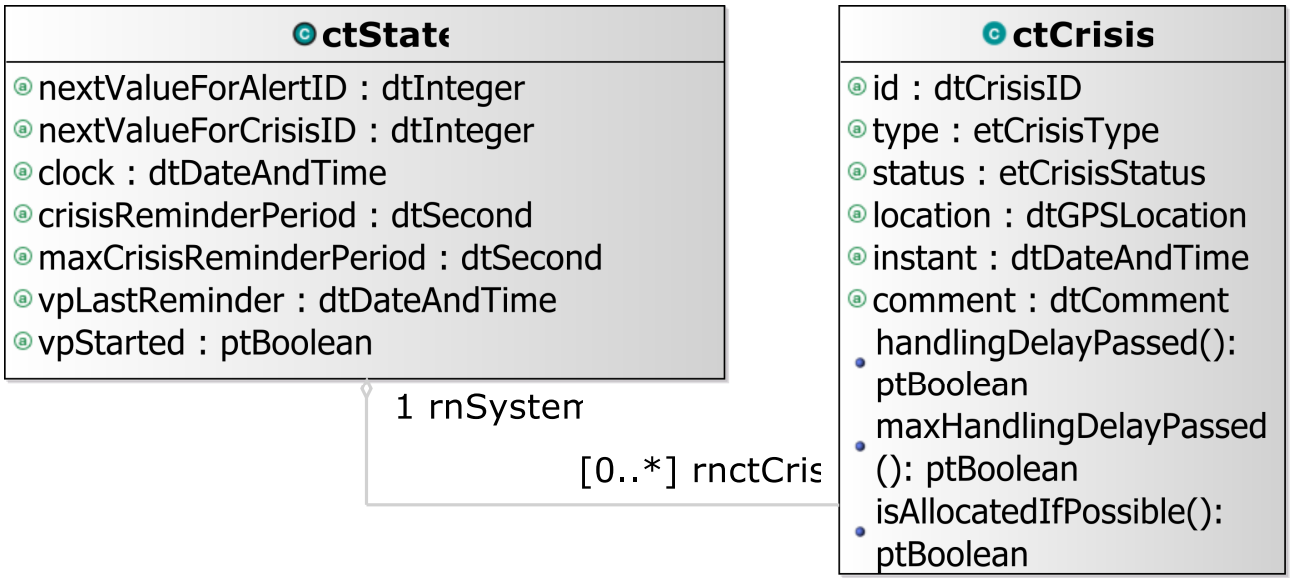


Figure 5.1: oeSollicitateCrisisHandling operation scope

OPERATION	
oeAddCoordinator	
sent to add a new coordinator in the system's post state and environment's post state.	
Parameters	
1	**AdtCoordinatorID: dtCoordinatorID** used to initialize the id field
2	**AdtLogin: dtLogin** used to initialize the login field
3	**AdtPassword: dtPassword** used to initialize the password field
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctAdministrator instance is considered logged)
Pre-Condition (functional)	
PreF 1	it is supposed that there cannot exist a ctCoordinator instance with the same `id` attribute as the one the administrator wants to delete.
Post-Condition (functional)	
PostF 1	the environment has a new instance of coordinator actor allowing for input/output message communication with the system.
PostF 2	the system's state has a new instance of ctCoordinator initialized with the given values.
PostF 3	the new actor instance and ctCoordinator instance are related.
PostF 4	the new actor instance and ctCoordinator instance are related according to the authenticated association.
PostF 5	the administrator actor is informed about the satisfaction of its request.

continues in next page . . .

. . . Operation table continuation

Post-Condition (protocol)	
PostP 1	none

The listing 5.3 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Pre Protocol:*/
3  preP{let TheSystem: ctState in
4   let TheActor:actAdministrator in
5
6   self.rnActor.rnSystem = TheSystem
7   and self.rnActor = TheActor
8
9  /* PreP01 */
10  and TheSystem.vpStarted = true
11 /* PreP02 */
12  and TheActor.rnctAuthenticated.vpIsLogged = true}
13
14 /* Pre Functional:*/
15 preF{let TheSystem: ctState in
16  let TheActor:actAdministrator in
17  let ColctCoordinators:Bag(ctCoordinator) in
18
19  self.rnActor.rnSystem = TheSystem
20  and self.rnActor = TheActor
21 /* PreF01 */
22  and TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
23    = ColctCoordinators
24  and ColctCoordinators->isEmpty() = true}
25
26 /* Post Functional:*/
27 postF{let TheSystem: ctState in
28  let TheactCoordinator:actCoordinator in
29  let ThectCoordinator:ctCoordinator in
30  self.rnActor.rnSystem = TheSystem
31  and self.rnActor = TheActor
32 /* PostF01 */
33  TheactCoordinator.init()
34 /* PostF02 */
35  and ThectCoordinator.init(AdtCoordinatorID,AdtLogin,AdtPassword)
36
37 /* PostF03 */
38  and TheactCoordinator@post.rnctCoordinator = ThectCoordinator
39
40 /* PostF04 */
41  and ThectCoordinator@post.rnactAuthenticated = TheactCoordinator
42
43 /* PostF05 */
44  and TheActor.rnInterfaceIN^ieCoordinatorAdded()}
45
46 /* Post Protocol:*/
47 postP{ true}
```

Listing 5.3: Messir (MCL-oriented) specification of the operation *oeAddCoordinator*.

5.2.2 Operation Model for oeDeleteCoordinator

The `oeDeleteCoordinator` operation has the following properties:

OPERATION	
oeDeleteCoordinator	
sent to delete an existing coordinator in the system's post state and environment's post state.	
Parameters	
1	**AdtCoordinatorID: dtCoordinatorID** used for ctCoordinator instance retrieval
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctAdministrator instance is considered logged)
Pre-Condition (functional)	
PreF 1	it is supposed that there exist one ctCoordinator instance with the same `id` attribute than the one the administrator wants to create.
Post-Condition (functional)	
PostF 1	the ctCoordinator class instance having the required id do not belong anymore to the post state as well as is related actCoordinator actor instance.
PostF 2	the administrator actor is informed about the satisfaction of its request.
Post-Condition (protocol)	
PostP 1	none

The listing 5.4 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Pre Protocol:*/
3  preP{let TheSystem: ctState in
4   let TheActor:actAdministrator in
5
6   self.rnActor.rnSystem = TheSystem
7   and self.rnActor = TheActor
8
9  /* PreP01 */
10  and TheSystem.vpStarted = true
11 /* PreP02 */
12  and TheActor.rnctAuthenticated.vpIsLogged = true}
13
14 /* Pre Functional:*/
15 preF{let TheSystem: ctState in
16  let TheActor:actAdministrator in
17
18  self.rnActor.rnSystem = TheSystem
19  and self.rnActor = TheActor
20 /* PreF01 */
21  TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
22  = ColctCoordinators
23  and ColctCoordinators->size().eq(1)}
24
25 /* Post Functional:*/
26 postF{let TheSystem: ctState in
27  let TheActor:actAdministrator in
28  let ThectCoordinator:ctCoordinator in
29  self.rnActor.rnSystem = TheSystem
30  and self.rnActor = TheActor
31 /* PostF01 */
```

```
32  TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
33  = ThectCoordinator
34  and ThectCoordinator.rnactCoordinator->forAll(msrIsKilled)
35  and ThectCoordinator.msrIsKilled
36
37  /* PostF02 */
38  and TheActor.rnInterfaceIN^ieCoordinatorDeleted()
39
40  /* Post Protocol:*/
41 /* PostP01 */
42  and true}
43
44 /* Post Protocol:*/
45 postP{ true}
```

Listing 5.4: Messir (MCL-oriented) specification of the operation *oeDeleteCoordinator*.

5.3 Environment - Out Interface Operation Scheme for actAuthenticated

5.3.1 Operation Model for oeCreateAlert

The `oeCreateAlert` operation has the following properties:

Operation	
oeCreateAlert	
Bla	
Parameters	
1	**AetHumanKind: etHumanKind**
	Bla
2	**AdtDate: dtDate**
	Bla
3	**AdtTime: dtTime**
	Bla
4	**AdtPhoneNumber: dtPhoneNumber**
	Bla
5	**AdtGPSLocation: dtGPSLocation**
	Bla
6	**AdtComment: dtComment**
	Bla
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	Bla
Pre-Condition (functional)	
PreF 1	Bla
Post-Condition (functional)	
PostF 1	Bla
Post-Condition (protocol)	
PostP 1	Bla

Example:

```
1  Bla
```

Listing 5.5: Example for *oeCreateAlert* operation

5.3.2 Operation Model for oeLogin

The `oeLogin` operation has the following properties:

OPERATION	
oeLogin	
sent to request authorization to request access secured system operations.	
Parameters	
1	**AdtLogin: dtLogin** first information used to determine accessibility rights for the actual actor.
2	**AdtPassword: dtPassword** second information used to determine accessibility rights for the actual actor.
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor is not already logged in ! (i.e. the associated ctAuthenticated instance is not considered logged)
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
PostF 1	if the login and password provided by the actor correspond to the ones that belong to the ctAuthenticated instance he is related to then a welcome message is sent to the actor (n.b. the logged status is changed as a post-protocol condition); else the actor is notified that he gave incorrect data and all the administrator actors existing in the environment are notified of an intrusion attempt.
Post-Condition (protocol)	
PostP 1	if the authentication information is correct then the actor is known to be logged in ! (i.e. the associated ctAuthenticated instance with given login and password is considered logged)

The listing 5.6 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Pre Protocol:*/
3  preP{let TheSystem: ctState in
4   let TheActor:actAuthenticated in
5   self.rnActor.rnSystem = TheSystem
6   and self.rnActor = TheActor
7
8  /* PreP01 */
9   and TheSystem.vpStarted = true
10 /* PreP02 */
11  and TheActor.rnctAuthenticated.vpIsLogged = false}
12
13 /* Pre Functional:*/
14 preF{/* PreF01 */
15 true}
```

```
16
17 /* Post Functional:*/
18 postF{let TheSystem: ctState in
19  let TheactAuthenticated:actAuthenticated in
20
21  let AptStringMessageForTheactAuthenticated: ptString in
22  let AptStringMessageForTheactAdministrator:ptString in
23
24  self.rnActor.rnSystem = TheSystem
25  and self.rnActor = TheactAuthenticated
26
27  and /* PostF01 */
28    if (TheactAuthenticated.rnctAuthenticated.pwd
29      = AdtPassword
30      and TheactAuthenticated.rnctAuthenticated.login
31        = AdtLogin
32      )
33    then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
34       and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
35       )
36    else (AptStringMessageForTheactAuthenticated
37       .eq('Wrong identification information ! Please try again ...')
38       and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
39       and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
40       and TheSystem.rnactAdministrator
41         .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
42       )
43    endif}
44
45 /* Post Protocol:*/
46 postP{ let TheSystem: ctState in
47  let TheactAuthenticated:actAuthenticated in
48
49  self.rnActor.rnSystem = TheSystem
50  and self.rnActor = TheactAuthenticated
51 /* PostP01 */
52  if (TheactAuthenticated.rnctAuthenticated.pwd = AdtPassword
53    and TheactAuthenticated.rnctAuthenticated.login = AdtLogin
54    )
55  then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
56  else true
57  endif}
```

Listing 5.6: Messir (MCL-oriented) specification of the operation *oeLogin*.

5.3.3 Operation Model for oeLogout

The `oeLogout` operation has the following properties:

OPERATION	
oeLogout sent to end the secured access to specific system operations.	
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor is currently logged in ! (i.e. the associated ctAuthenticated instance is considered logged)
Pre-Condition (functional)	
PreF 1	
Post-Condition (functional)	

continues in next page . . .

... Operation table continuation

PostF 1	a logout confirmation message is sent to the actor (n.b. the logged status is changed as a post-protocol condition)
Post-Condition (protocol)	
PostP 1	the actor is known to be logged out ! (i.e. the associated ctAuthenticated instance with given login and password is considered logged out)

The listing 5.7 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Pre Protocol:*/
3  preP{let TheSystem: ctState in
4   let TheActor:actAdministrator in
5   self.rnActor.rnSystem = TheSystem
6   and self.rnActor = TheActor
7
8  /* PreP01 */
9   and TheSystem.vpStarted = true
10 /* PreP02 */
11  and TheActor.rnctAuthenticated.vpIsLogged = true}
12
13 /* Pre Functional:*/
14 preF{/* PreF01 */
15 true}
16
17 /* Post Functional:*/
18 postF{let TheSystem: ctState in
19  let TheactAuthenticated:actAuthenticated in
20  let AptStringMessageForTheactAuthenticated: ptString in
21
22  self.rnActor.rnSystem = TheSystem
23  and self.rnActor = TheactAuthenticated
24
25  /* PostF01 */
26  AptStringMessageForTheactAuthenticated.eq('You are logged out ! Good Bye ...')
27  and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)}
28
29 /* Post Protocol:*/
30 postP{ let TheSystem: ctState in
31  let TheactAuthenticated:actAuthenticated in
32
33  self.rnActor.rnSystem = TheSystem
34  and self.rnActor = TheactAuthenticated.asSet
35 /* PostP01 */
36  TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = false}
```

Listing 5.7: Messir (MCL-oriented) specification of the operation *oeLogout*.

5.4 Environment - Out Interface Operation Scheme for actComCompany

5.4.1 Operation Model for oeAlert

The `oeAlert` operation has the following properties:

OPERATION

continues in next page ...

. . . Operation table continuation

oeAlert	
Any human having a phone able to connect to the communication companies using the *iCrash* system can send his company an sms message with structured information in order to declare an alert.	
Parameters	
1	**AetHumanKind: etHumanKind** the kind of human informing of an alert.
2	**AdtDate: dtDate** the date of the alert
3	**AdtTime: dtTime** the time of the alert
4	**AdtPhoneNumber: dtPhoneNumber** the phone number of the human sending the alert SMS message
5	**AdtGPSLocation: dtGPSLocation** the GPS position of the phone at the date and time the message was sent.
6	**AdtComment: dtComment** a free text message sent by the human providing information on the alert that he wants to declare
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is supposed to be created and initialized.
Pre-Condition (functional)	
PreF 1	the date and time the alert is declared is supposed to be in the past with respect to the current time known by the system.
Post-Condition (functional)	
PostF 1	the ctState attribute for the next value for alert IDs is incremented by one at post.
PostF 2	a new alert instance exists in the post state with status pending, instant information (resp. GPS location and comment) based on date and time provided (resp. position and comment); and with alert ID being a string conversion of the dtInteger value available in the pre state in the ctState instance.
PostF 3	if there exist no already registered alert near to the alert currently declared then a new crisis is added in the post state and initialized with: its ID being the one provided by the ctState instance (which is incremented by one in the post state), its type considered as small, its status being pending, its declared time being the same than the alert and a default comment indicating that a report will come later on. else the crisis to which the new alert must be related to is the one related to any alert nearby in the pre-state.
PostF 4	the post state relates the new alert to the previously characterized crisis.
PostF 5	if there is no ctHuman instance having same phone number and same kind in the pre-state then a new one is added in the post-state with given phone number and kind and is associated to the communication company actor used to declare the alert. else the pre-state one is chosen
PostF 6	and this specified ctHuman is related to the new alert thus indicating he has signled the alert.
Post-Condition (protocol)	
PostP 1	none

The listing 5.8 provides the Messir (MCL-oriented) specification of the operation.

```

/* Pre Protocol:*/
preP{let TheSystem: ctState in
 self.rnActor.rnSystem = TheSystem

/* PreP01 */
 and TheSystem.vpStarted = true}

/* Pre Functional:*/
preF{let TheSystem: ctState in
 self.rnActor.rnSystem = TheSystem

/* PreF01 */
 and (TheSystem.clock.date.gt(AdtDate)
    or (TheSystem.clock.date.eq(AdtDate)
      and TheSystem.clock.time.gt(AdtTime)
     )
   )}

/* Post Functional:*/
postF{let TheSystem: ctState in

 let ActHuman:ctHuman in
 let TheactComCompany:actComCompany in
 let ActAlert:ctAlert in
 let AAlertInstant:dtDateAndTime in
 let AetAlertStatus:etAlertStatus in
 let ActAlertNearBy:ctAlert in
 let ActCrisis:ctCrisis in
 let AdtCrisisID:dtCrisisID in
 let AetCrisisType:etCrisisType in
 let AetCrisisStatus:etCrisisStatus in
 let ACrisisInstant:dtDateAndTime in
 let ACrisisdtComment:dtComment in
 let AptStringMessage:ptString in
 let AdtSMS:dtSMS in
 let AdtAlertID:dtAlertID in

 self.rnActor.rnSystem = TheSystem
 and self.rnActor = TheactComCompany
/* PostF01 */
 TheSystem.nextValueForAlertID=PrenextValueForAlertID
 and PrenextValueForAlertID.add(1) = PostnextValueForAlertID
 and TheSystem@post.nextValueForAlertID = PostnextValueForAlertID

 /* PostF02 */
and AAlertInstant.date=AdtDate
and AAlertInstant.time=AdtTime

and AetAlertStatus=pending

and TheSystem.nextValueForAlertID.todtString().eq(AdtAlertID)

and ActAlert.init(AdtAlertID,
         AetAlertStatus,
         AdtGPSLocation,
         AAlertInstant,
         AdtComment)

 /* PostF03 */
and TheSystem.rnctAlert.select(location.isNearTo(AdtGPSLocation)) = ColctAlertsNearBy
and if (ColctAlertsNearBy->size()=0)
  then (TheSystem.nextValueForCrisisID = PrenextValueForCrisisID
     and PrenextValueForCrisisID.add(1) = PostnextValueForCrisisID
     and TheSystem@post.nextValueForCrisisID = PostnextValueForCrisisID
     and TheSystem.nextValueForCrisisID.todtString().eq(AdtCrisisID)
     and AdtCrisisType = small
```

```
68      and AetCrisisStatus = pending
69      and ACrisisInstant= AAlertInstant
70      and ACrisisdtComment = 'no reporting yet defined'
71      and ActCrisis.init( AdtCrisisID,
72                AdtCrisisType,
73                AetCrisisStatus,
74                AdtGPSLocation,
75                ACrisisInstant,
76                ACrisisdtComment)
77      )
78  else (ColctAlertsNearBy.rnTheCrisis->msrAny(true) = ActCrisis)
79  endif
80
81  /* PostF04 */
82 and ActAlert@post.rnTheCrisis = ActCrisis
83
84 /* PostF05 */
85 and TheSystem.rnctHuman->select(id.eq(AdtPhoneNumber)) = HumanCol1
86
87 and HumanCol1->select(kind.etEq(AetHumanKind)) = HumanCol2
88 and if (HumanCol2->msrIsEmpty)
89   then (ActHuman.init(AdtPhoneNumber,AetHumanKind)
90      and ActHuman@post.rnactComCompany = TheactComCompany
91      )
92   else (HumanCol2->any(true) = ActHuman)
93   endif
94
95  and ActHuman.rnSignaled->msrIncluding(ActAlert) = ColAlerts
96
97  and ActHuman@post.rnSignaled = ColAlerts
98
99 /* PostF06 */
100 AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
101 and TheactComCompany.rnInterfaceIN^ieSmsSend(AdtPhoneNumber,AdtSMS)}
102
103 /* Post Protocol:*/
104 postP{ true}
```

Listing 5.8: Messir (MCL-oriented) specification of the operation *oeAlert*.

Figure 5.2 shows concept model elements in the scope of the oeAlert operation

Figure 5.3 shows concept model elements in the scope of the oeAlert operation

5.5 Environment - Out Interface Operation Scheme for actCoordinator

5.5.1 Operation Model for oeCloseCrisis

The `oeCloseCrisis` operation has the following properties:

OPERATION	
oeCloseCrisis	
sent to indicate that a crisis should be considered as closed.	
Parameters	
1	**AdtCrisisID: dtCrisisID**
	the identification information used to determine the crisis to close
Return type	
ptBoolean	

continues in next page . . .

... Operation table continuation

Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
Pre-Condition (functional)	
PreF 1	it is supposed that there exist one ctCrisis instance with the same `id` attribute value as the one provided by the coordinator actor who wants to close.
Post-Condition (functional)	
PostF 1	the ctCrisis class instance having the provided id is considered closed in the post state.
PostF 2	There is no handler declared in the system as associated to the crisis.
PostF 3	all the alert instances associated to this crisis do not belong any more to the system's post state.
PostF 4	the coordinator actor is informed about the satisfaction of its request.
Post-Condition (protocol)	
PostP 1	none

5.5.2 Operation Model for oeGetAlertsSet

The `oeGetAlertsSet` operation has the following properties:

OPERATION	
oeGetAlertsSet	
sent to request all the ctAlert instances having a specific status.	
Parameters	
1	**AetAlertStatus: etAlertStatus** the criteria used to select the alerts to send back to the actor
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
PostF 1	the post state is the one obtained by satisfying the `isSentToCoordinator` predicate for each alert having the provided status and for the actor sending the message. (cf. specification of `isSentToCoordinator` predicate given for the `ctAlert` type.
Post-Condition (protocol)	
PostP 1	none

5.5.3 Operation Model for oeGetCrisisSet

The `oeGetCrisisSet` operation has the following properties:

OPERATION

continues in next page ...

. . . Operation table continuation

oeGetCrisisSet	
sent to request all the ctCrisis instances having a specific status.	
Parameters	
1	**AetCrisisStatus: etCrisisStatus** the status information used to determine the crisis to send back to the actor
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
PostF 1	the post state is the one obtained by satisfying the `isSentToCoordinator` predicate for each crisis having the provided status and for the actor sending the message `ieSendACrisis`. (cf. specification of `isSentToCoordinator` predicate given for the `ctCrisis` type.
Post-Condition (protocol)	
PostP 1	none

5.5.4 Operation Model for oeInvalidateAlert

The `oeInvalidateAlert` operation has the following properties:

OPERATION	
oeInvalidateAlert	
sent to indicate that an alert should be considered as closed.	
Parameters	
1	**AdtAlertID: dtAlertID** the identification information used to determine the alert to close
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
Pre-Condition (functional)	
PreF 1	it is supposed that there exist one ctAlert instance with the same `id` attribute value as the one provided by the coordinator actor who wants to close.
Post-Condition (functional)	
PostF 1	the ctAlert class instance having the provided id is considered closed in the post state.
PostF 2	the coordinator actor is informed about the satisfaction of its request.
Post-Condition (protocol)	
PostP 1	none

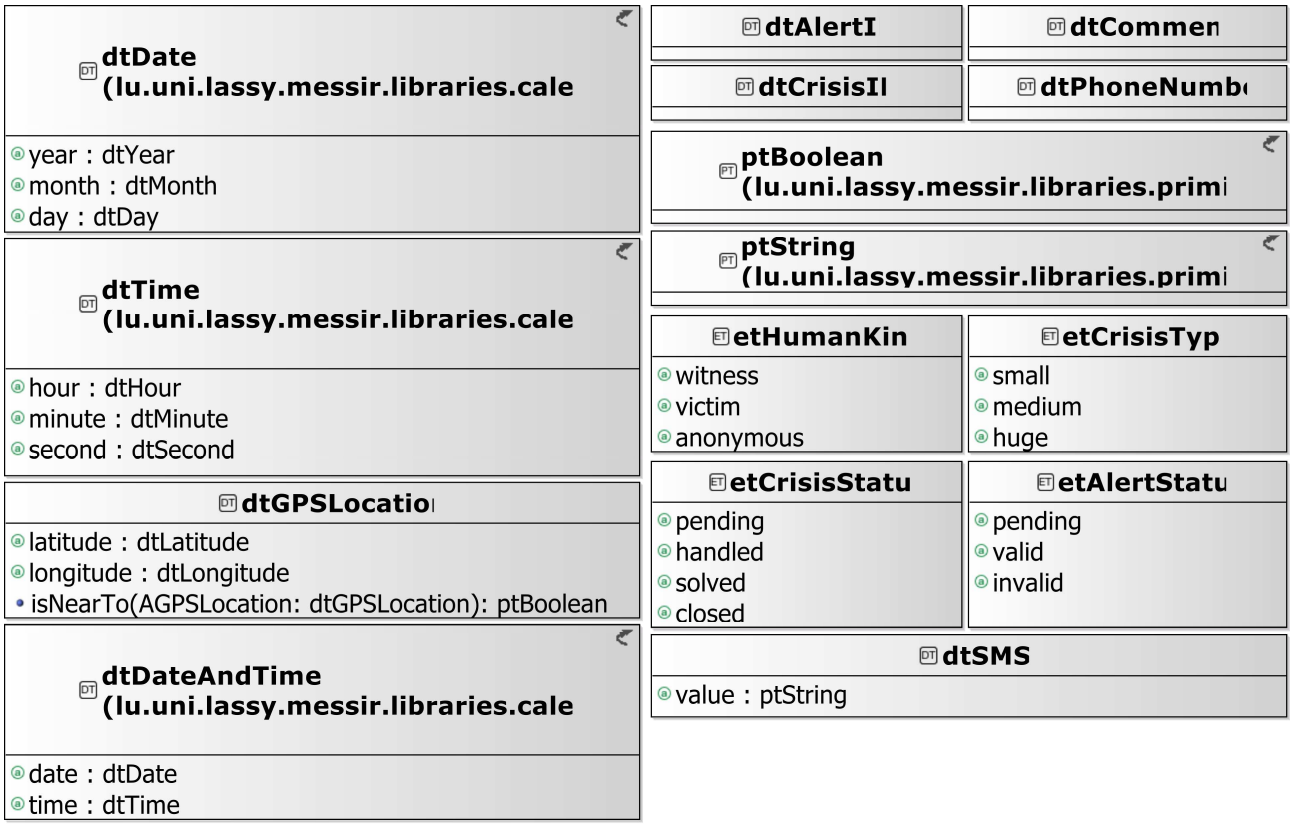


Figure 5.2: oeAlert operation scope

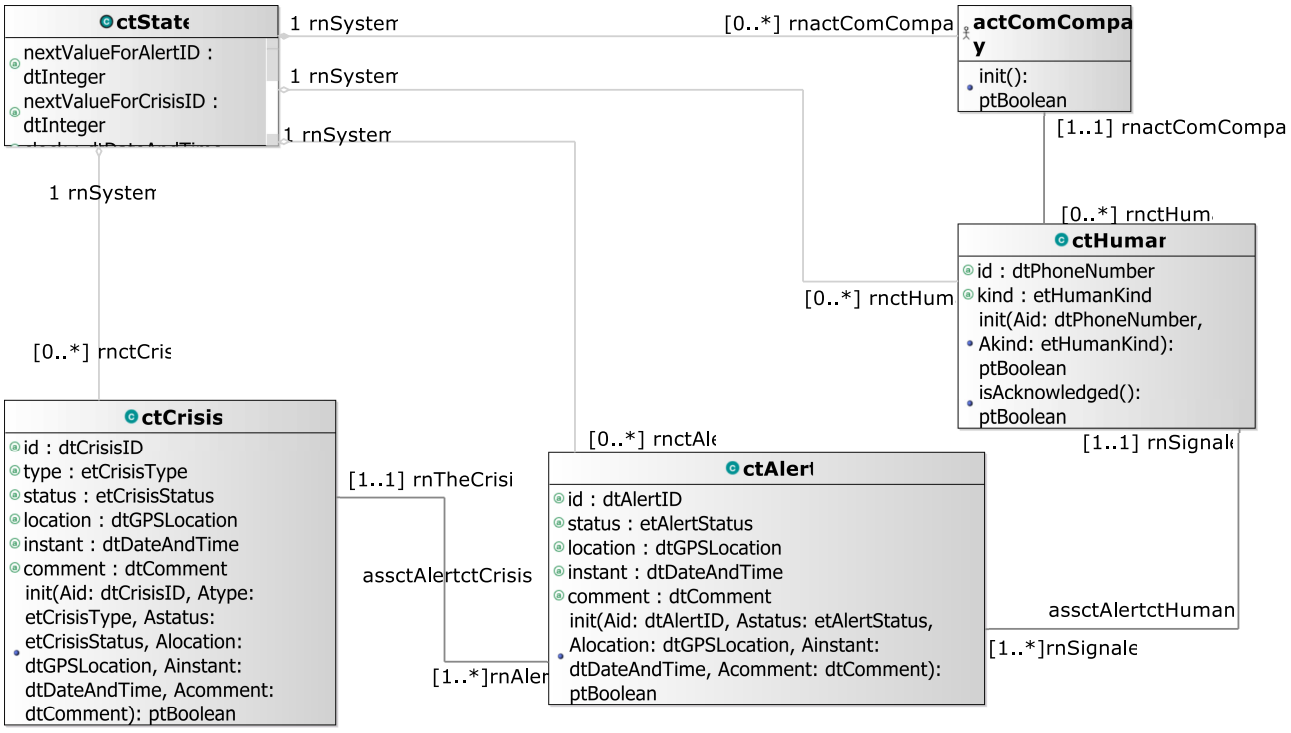


Figure 5.3: oeAlert operation scope

5.5.5 Operation Model for oeReportOnCrisis

The `oeReportOnCrisis` operation has the following properties:

Operation	
oeReportOnCrisis	
sent to update the textual information available for a specific handled crisis.	
Parameters	
1	**AdtCrisisID: dtCrisisID** the identification information used to determine the crisis to report on
2	**AdtComment: dtComment** the textual information commenting the crisis
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
Pre-Condition (functional)	
PreF 1	it is supposed that there exist one crisis in the pre state having the given id.
Post-Condition (functional)	
PostF 1	the comment attribute of the crisis instance having the given id is replaced by the given one and the requesting actor is notified of this update.
Post-Condition (protocol)	
PostP 1	none

5.5.6 Operation Model for oeSetCrisisHandler

The `oeSetCrisisHandler` operation has the following properties:

Operation	
oeSetCrisisHandler	
sent to declare himself as been the handler of a crisis having the specified id.	
Parameters	
1	**AdtCrisisID: dtCrisisID** the identification information used to determine the crisis
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
Pre-Condition (functional)	
PreF 1	there exist one crisis having the given id in the pre-state.
Post-Condition (functional)	
PostF 1	the ctCrisis instance having the provided id is in handled status at poststate and is associated to the actor that sends the message (which himself is notified with a textual message as confirmation).

continues in next page . . .

... Operation table continuation

PostF 2	All the alerts related to this crisis are sent to the actor such that he can decide how to handle them.
PostF 3	if the crisis was already handled at pre-sate then the associated handler actor is notified about the change of handler for one of his crisis (n.b. it might be the same even if not relevant).
PostF 4	a message is sent to the communication company for any human related to an alert associated to the crisis. A human will receive as many messages as alerts he sent despite the fact that they might relate to the same crisis (i.e. one alert, one acknoledgement).
Post-Condition (protocol)	
PostP 1	none

5.5.7 Operation Model for oeSetCrisisStatus

The `oeSetCrisisStatus` operation has the following properties:

OPERATION	
oeSetCrisisStatus	
sent to define the handling status of a specific crisis.	
Parameters	
1	**AdtCrisisID: dtCrisisID** the identification information used to determine the crisis
2	**AetCrisisStatus: etCrisisStatus** the new status value
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
Pre-Condition (functional)	
PreF 1	it is supposed that there exist one crisis in the pre state having the given id.
Post-Condition (functional)	
PostF 1	the crisis status attribute of the crisis instance having the given id is replaced by the given one and the requesting actor is notified of this update.
Post-Condition (protocol)	
PostP 1	none

5.5.8 Operation Model for oeSetCrisisType

The `oeSetCrisisType` operation has the following properties:

OPERATION	
oeSetCrisisType	
sent to define the gravity type of a specific crisis.	
Parameters	
1	**AdtCrisisID: dtCrisisID** the identification information used to determine the crisis

continues in next page ...

... Operation table continuation

2	**AetCrisisType: etCrisisType** the new type value
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
Pre-Condition (functional)	
PreF 1	it is supposed that there exist one crisis in the pre state having the given id.
Post-Condition (functional)	
PostF 1	the crisis type attribute of the crisis instance having the given id is replaced by the given one and the requesting actor is notified of this update.
Post-Condition (protocol)	
PostP 1	none

5.5.9 Operation Model for oeUpdateCrisis

The `oeUpdateCrisis` operation has the following properties:

OPERATION	
oeUpdateCrisis Output event which is sent when a crisis is updated	
Parameters	
1	**AdtCrisisID: dtCrisisID** The ID of the crisis
2	**AdtDate: dtDate** The current date
3	**AdtTime: dtTime** The current time in hour, minutes and seconds
4	**AdtComment: dtComment** Comment made by the creator of the alert and editable by the coordinator
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	The system must be turned on
Pre-Condition (functional)	
PreF 1	The updated date and time must be greater than the current date and time
Post-Condition (functional)	
PostF 1	
Post-Condition (protocol)	
PostP 1	

The listing 5.9 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Pre Protocol:*/
3  preP{TheSystem.vpStarted = true}
4
5  /* Pre Functional:*/
6  preF{let TheSystem: ctState in
7      self.rnActor.rnCoordinator = TheCoordinator
8
9      and (TheSystem.clock.date.gt(AdtDate)
10         or (TheSystem.clock.date.eq(AdtDate)
11           and TheSystem.clock.time.gt(AdtTime)
12         )
13       )}
14
15 /* Post Functional:*/
16 postF{let TheSystem: ctState in
17     let ActCrisis:ctCrisis in
18     let AdtCrisisID:dtCrisisID in
19     let AetCrisisType:etCrisisType in
20     let AetCrisisStatus:etCrisisStatus in
21     let ACrisisInstant:dtDateAndTime in
22     let ACrisisdtComment:dtComment in
23     let AptStringMessage:ptString in
24
25     self.rnActor.rnCoordinator = TheCoordinator
26
27     and ACrisisInstant.date = AdtDate
28     and ACrisisInstant.time = AdtTime
29
30     and ACrisisStatus = pending
31
32     and ActCrisis.update(
33      AetAlertStatus,
34      AdtDate,
35       AdtTimee,
36       AdtComment
37     )}
38
39 /* Post Protocol:*/
40 postP{ true}
```

Listing 5.9: Messir (MCL-oriented) specification of the operation *oeUpdateCrisis*.

5.5.10 Operation Model for oeValidateAlert

The `oeValidateAlert` operation has the following properties:

OPERATION	
oeValidateAlert	
sent to indicate that a specific alert is not a fake.	
Parameters	
1	**AdtAlertID: dtAlertID**
	the identification information used to determine the alert instance
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
Pre-Condition (functional)	

continues in next page . . .

. . . Operation table continuation

PreF 1	it is supposed that there exist one ctAlert instance with the same `id` attribute value as the one provided by the coordinator actor who wants to validate.
Post-Condition (functional)	
PostF 1	the ctAlert class instance having the provided id is considered as valid in the post state and the coordinator actor is informed about the satisfaction of its request.
Post-Condition (protocol)	
PostP 1	none

5.6 Environment - Out Interface Operation Scheme for actMsrCreator

5.6.1 Operation Model for oeCreateSystemAndEnvironment

The `oeCreateSystemAndEnvironment` operation has the following properties:

OPERATION	
oeCreateSystemAndEnvironment sent to request the initialization of the system's class instances and the environment actors instances.	
Parameters	
1	**AqtyComCompanies: ptInteger** the quantity of communication companies to create in the environment
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	none
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
PostF 1	the ctState instance is initialized with the integer 1 for the crisis and alert counters used for their identifications, a value for the clock corresponding to a default inital time (i.e. January 1st, 1970) the crisis reminder period is set to 300 seconds, the maximum crisis reminder period is fixed to 1200 seconds (i.e. 20 minutes), an initial value for the automatic reminder period equal to the current date and time and the system is considered in a started state. **Those predicates must be satisfied first since all the other depend on the existence of a ctState instance !**
PostF 2	the `actMsrCreator` actor instance is initiated (remember that since the `oeCreateSystemAndEnvironment` is a special event it role is to make consistent the post state thus creating the actor and its interfaces is required even though the sending of this message logically would need the actor and its interfaces to already exist ...).
PostF 3	the environment for communication company actors, in the post state, is made of `AqtyComCompanies` instances allowing for receiving and sending messages to humans.
PostF 4	the environment for administrator actors, in the post state, is made of one instance.
PostF 5	the environment for activator actors, in the post state, is made of one instance allowing for automatic message sending based on current system's and environment state'.
PostF 6	the set of ctAdministrator instances at post is made of one instance initialized with 'icrashadmin' (resp. '7WXC1359') for login (resp. password) values.

continues in next page . . .

... Operation table continuation

PostF 7	the association between ctAdministrator and actAdministrator is made of one couple made of the conjointly specified instances.
Post-Condition (protocol)	
PostP 1	none is given since the only protocol variable to be modified in the post state is the one initialized with the ctState instance (i.e. vpStarted).

The listing 5.10 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Pre Protocol:*/
3  preP{true}
4
5  /* Pre Functional:*/
6  preF{true}
7
8  /* Post Functional:*/
9  postF{let TheSystem: ctState in
10  let AactMsrCreator: actMsrCreator in
11  let AactAdministrator: actAdministrator in
12  let AnextValueForAlertID: dtInteger in
13  let AnextValueForCrisisID: dtInteger in
14  let Aclock: dtDateAndTime in
15  let AcrisisReminderPeriod: dtSecond in
16  let AmaxCrisisReminderPeriod: dtSecond in
17  let AvpStarted: ptBoolean in
18
19  /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
20  AnextValueForAlertID.value.eq(1)
21  and AnextValueForCrisisID.value.eq(1)
22  and Aclock.date.year.value = 1970
23  and Aclock.date.month.value = 01
24  and Aclock.date.day.value = 01
25  and Aclock.time.hour.value = 00
26  and Aclock.time.minute.value = 00
27  and Aclock.time.second.value = 00
28
29  and AcrisisReminderPeriod.value.eq(300)
30  and AmaxCrisisReminderPeriod.value.eq(1200)
31  and AvpStarted = true
32  and TheSystem.init(AnextValueForAlertID,
33            AnextValueForCrisisID,
34            Aclock,
35            AcrisisReminderPeriod,
36            AmaxCrisisReminderPeriod,
37            Aclock,
38            AvpStarted
39           )
40  /* PostF02*/
41  and AactMsrCreator.init()
42  /* PostF03 */
43  and let AactComCompanyCol: Bag(actComCompany) in
44  AactComCompanyCol->size() = AqtyComCompanies
45  AactComCompanyCol-> forAll(init())
46  /* PostF04*/
47  and AactAdministrator.init()
48  /* PostF05*/
49  and let AactActivator:actActivator in
50  AactActivator.init()
51 /* PostF06 */
52  and let ActAdministrator:ctAdministrator in
53    let AdtLogin:dtLogin in
54    let AdtPassword:dtPassword in
```

```
55     AdtLogin.value.eq('icrashadmin')
56     and AdtPassword.value.eq('7WXC1359')
57     and ActAdministrator.init(AdtLogin,AdtPassword)
58   /* PostF07*/
59   and ActAdministrator@post.rnactAuthenticated = AactAdministrator}
60
61 /* Post Protocol:*/
62 postP{ true}
```

Listing 5.10: Messiр (MCL-oriented) specification of the operation *oeCreateSystemAndEnvironment*.

Figure 5.4 shows all the concept model elements in the scope of the oeCreateSystemAndEnvironment operation

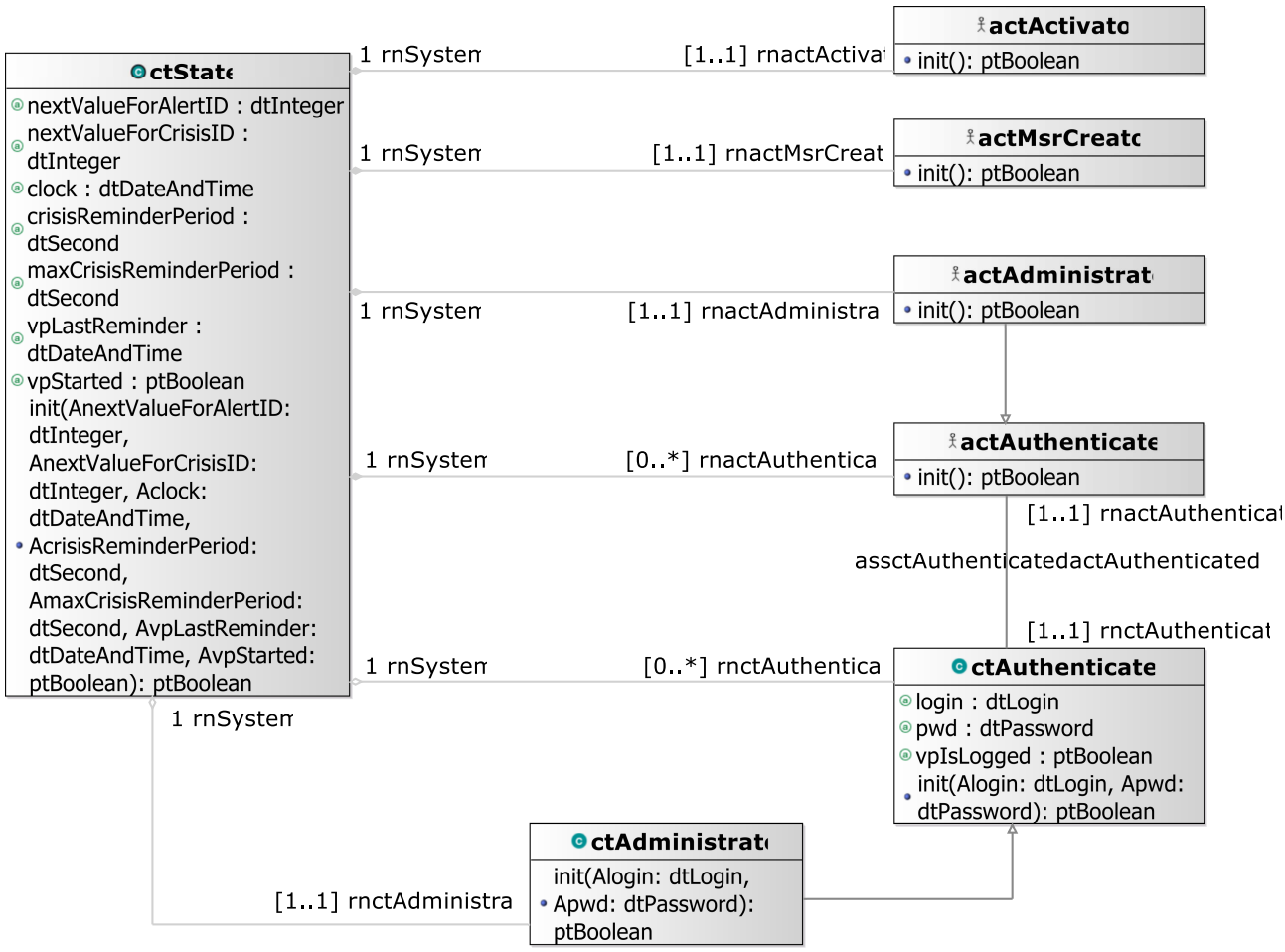


Figure 5.4: oeCreateSystemAndEnvironment operation scope

5.7 Environment - Actor Operation Scheme for actMsrCreator

5.7.1 Operation Model for init

The `init` operation has the following properties:

Operation
init
used to create an instance of the actor together with its interface instances and update the assocations with the `ctState` instance.
Return type
ptBoolean

5.8 Primary Types - Operation Schemes for Class ctAdministrator

5.8.1 Operation Model for init

The `init` operation has the following properties:

Operation	
init	
used to initialize the current object as a new instance of the ctAdministrator type.	
Parameters	
1	**Alogin: dtLogin** used to initialize the login field
2	**Apwd: dtPassword** used to initialize the password field
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the system poststate includes the current object as a new ctAdministrator instance having its login and password attributes equal to the one provided as parameters and its vpIsLogged attribute equal to false.

The listing 5.11 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{if
4  (
5  let Self:ctAdministrator in
6  /* Post F01 */
7  Self.login(Alogin)
8  and Self.pwd = Apwd
9  and Self.vpIsLogged = false
10
11 /* Post F02 */
12 and (Self.oclIsNew and self = Self)
13 )
14 then (result = true)
15 else (result = false)
16 endif}
```

Listing 5.11: Messir (MCL-oriented) specification of the operation *init*.

5.9 Primary Types - Operation Schemes for Class ctAlert

5.9.1 Operation Model for init

The `init` operation has the following properties:

OPERATION	
init	
used to initialize the current object as a new instance of the ctAlert type.	
Parameters	
1	**Aid: dtAlertID** used to initialize the id field
2	**Astatus: etAlertStatus** used to initialize the status field
3	**Alocation: dtGPSLocation** used to initialize the location field
4	**Ainstant: dtDateAndTime** used to initialize the instant field
5	**Acomment: dtComment** used to initialize the comment field
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the system poststate includes the current object as a new ctAlert instance having its attributes equal to the ones provided as parameters.

The listing 5.12 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{if
4  (
5  /* Post F01 */
6  let Self:ctAlert in
7  Self.id = Aid
8  and Self.status = Astatus
9  and Self.location = Alocation
10 and Self.instant = Ainstant
11 and Self.comment = Acomment
12 /* Post F02 */
13 and (Self.oclIsNew and self = Self)
14 )
15 then (result = true)
16 else (result = false)
17 endif}
```

Listing 5.12: Messir (MCL-oriented) specification of the operation *init*.

5.9.2 Operation Model for isSentToCoordinator

The `isSentToCoordinator` operation has the following properties:

Operation	
isSentToCoordinator	
used to provide a given coordinator with current alert information.	
Parameters	
1	**AactCoordinator: actCoordinator** the message destination
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the message ieSendAnAlert is sent to the input interface of the given coordinator actor with the current alert as parameter value.

The listing 5.13 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{if
4  (
5  /* Post F01 */
6  AactCoordinator.rnInterfaceIN.ieSendAnAlert(self)
7  )
8  then (result = true)
9  else (result = false)
10 endif}
```

Listing 5.13: Messir (MCL-oriented) specification of the operation *isSentToCoordinator*.

5.10 Primary Types - Operation Schemes for Class ctAuthenticated

5.10.1 Operation Model for init

The `init` operation has the following properties:

Operation	
init	
used to initialize the current object as a new instance of the ctAuthenticated type.	
Parameters	
1	**Alogin: dtLogin** used to initialize the login field
2	**Apwd: dtPassword** used to initialize the password field
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the system poststate includes the current object as a new ctAuthenticated instance having its attributes equal to the ones provided as parameters.

5.11 Primary Types - Operation Schemes for Class ctCoordinator

5.11.1 Operation Model for init

The `init` operation has the following properties:

OPERATION	
init	
used to initialize the current object as a new instance of the ctCoordinator type.	
Parameters	
1	**Aid: dtCoordinatorID** used to initialize the id field
2	**Alogin: dtLogin** used to initialize the login field
3	**Apwd: dtPassword** used to initialize the password field
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the system poststate includes the current object as a new ctCoordinator instance having its attributes equal to the ones provided as parameters.

The listing 5.14 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{if
4  (
5  /* Post F01 */
6  let Self:ctCoordinator in
7  Self.id = Aid
8  and Self.login = Alogin
9  and Self.pwd = Apwd
10 and Self.vpIsLogged = false
11 /* Post F02 */
12 and (Self.oclIsNew and self = Self)
13 )
14 then (result = true)
15 else (result = false)
16 endif}
```

Listing 5.14: Messir (MCL-oriented) specification of the operation *init*.

5.12 Primary Types - Operation Schemes for Class ctCrisis

5.12.1 Operation Model for init

The `init` operation has the following properties:

OPERATION

continues in next page . . .

... Operation table continuation

init	
used to initialize the current object as a new instance of the ctCrisis type.	
Parameters	
1	**Aid: dtCrisisID** used to initialize the id field
2	**Atype: etCrisisType** used to initialize the type field
3	**Astatus: etCrisisStatus** used to initialize the status field
4	**Alocation: dtGPSLocation** used to initialize the location field
5	**Ainstant: dtDateAndTime** used to initialize the instant field
6	**Acomment: dtComment** used to initialize the comment field
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the system poststate includes the current object as a new ctCrisis instance having its attributes equal to the ones provided as parameters.

The listing 5.15 provides the Messiр (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{if
4  (
5  /* Post F01 */
6  let Self:ctCrisis in
7  Self.id = Aid
8  and Self.type = Atype
9  and Self.status = Astatus
10 and Self.location = Alocation
11 and Self.instant = Ainstant
12 and Self.comment = Acomment
13 /* Post F02 */
14 and (Self.oclIsNew and self = Self)
15 )
16 then (result = true)
17 else (result = false)
18 endif}
```

Listing 5.15: Messiр (MCL-oriented) specification of the operation *init*.

5.12.2 Operation Model for handlingDelayPassed

The `handlingDelayPassed` operation has the following properties:

OPERATION
handlingDelayPassed
used to determine if the crisis stood too longly in a pending status since last reminder.

continues in next page ...

... Operation table continuation

Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the crisis is in pending status and if the duration between the current ctState clock information and the last reminder is greater than the crisis reminder period duration.

The listing 5.16 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheSystem:ctState in
4  let CurrentClockSecondsQty:dtInteger in
5  let vpLastReminderSecondsQty:dtInteger in
6  let CrisisReminderPeriod:dtSecond in
7  if
8  ( /* Post F01 */
9   self.rnSystem = TheSystem
10  and self.status = pending
11  and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
12  and TheSystem.vpLastReminder.toSecondsQty() = vpLastReminderSecondsQty
13  and TheSystem.crisisReminderPeriod = CrisisReminderPeriod
14  and CurrentClockSecondsQty.sub(vpLastReminderSecondsQty).gt(CrisisReminderPeriod) = true
15 )
16 then (result = true)
17 else (result = false)
18 endif}
```

Listing 5.16: Messir (MCL-oriented) specification of the operation *handlingDelayPassed*.

5.12.3 Operation Model for maxHandlingDelayPassed

The `maxHandlingDelayPassed` operation has the following properties:

OPERATION	
maxHandlingDelayPassed used to determine if the crisis stood too longly in a pending status since its creation.	
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the crisis is in pending status and if the duration between the current ctState clock information and the crisis instant is greater than the maximum reminder period duration.

The listing 5.17 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheSystem:ctState in
4  let CurrentClockSecondsQty:dtInteger in
5  let CrisisInstantSecondsQty:dtInteger in
6  let MaxCrisisReminderPeriod:dtSecond in
```

```
7  if
8  ( /* Post F01 */
9   self.rnSystem = TheSystem
10  and self.status = pending
11  and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
12  and Self.instant.toSecondsQty() = CrisisInstantSecondsQty
13  and TheSystem.maxCrisisReminderPeriod = MaxCrisisReminderPeriod
14  and CurrentClockSecondsQty.sub(CrisisInstantSecondsQty)
15                .gt(MaxCrisisReminderPeriod)
16 )
17 then (result = true)
18 else (result = false)
19 endif}
```

Listing 5.17: Messir (MCL-oriented) specification of the operation *maxHandlingDelayPassed*.

5.12.4 Operation Model for isSentToCoordinator

The `isSentToCoordinator` operation has the following properties:

OPERATION	
isSentToCoordinator	
used to provide a given coordinator with current crisis information.	
Parameters	
1	**AactCoordinator: actCoordinator**
	the message destination actor
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the message ieSendACrisis is sent by the simulator to the input interface of the given coordinator actor with the current crisis as parameter value.

The listing 5.18 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{if
4  (
5  /* Post F01 */
6   AactCoordinator.rnInterfaceIN.ieSendACrisis(self)
7  )
8  then (result = true)
9  else (result = false)
10 endif}
```

Listing 5.18: Messir (MCL-oriented) specification of the operation *isSentToCoordinator*.

5.12.5 Operation Model for isAllocatedIfPossible

The `isAllocatedIfPossible` operation has the following properties:

OPERATION

continues in next page . . .

... Operation table continuation

isAllocatedIfPossible	
used to allocate a crisis to a coordinator if any or to alert the administrator of crisis waiting to be handled.	
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the duration between the crisis creation and the system's clock is greater than the maximum delay defined and
PostF 2	if there exist at least one coordinator then (a) the post state associates to the crisis any of the existing coordinators and (b) the coordinator is informed that he is now the handlers of the crisis whose ID is communicated
PostF 3	else a message is sent to all known administrators to request creation of new coordinators.

The listing 5.19 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{if (
4  /* Post F01 */
5  self.maxHandlingDelayPassed()
6  and
7   if (TheSystem.rnactCoordinator->msrIsEmpty = false)
8   then (
9     /* Post F02 */
10    TheSystem.rnactCoordinator->msrAny(true) = TheCoordinatorActor
11    and TheCoordinatorActor.rnctCoordinator = TheCoordinator
12    and self@post.rnHandler = TheCoordinator
13    and self@post.status = handled
14    and self.id.value = TheCrisisIDptString
15    and 'You are now considered as handling the crisis having ID: '
16      .ptStringConcat(TheCrisisIDptString) = TheMessage
17     and TheCoordinatorActor.rnInterfaceIN^ieMessage(TheMessage)
18   )
19   else ( /* Post F03 */
20      TheSystem.rnactAdministrator
21      ->forAll(rnInterfaceIN.ieMessage('Please add new coordinators to handle pending crisis !'))
22   )
23   endif
24   )
25 then (result = true)
26 else (result = false)
27 endif}
```

Listing 5.19: Messir (MCL-oriented) specification of the operation *isAllocatedIfPossible*.

5.13 Primary Types - Operation Schemes for Class ctHuman

5.13.1 Operation Model for init

The `init` operation has the following properties:

OPERATION

continues in next page ...

. . . Operation table continuation

init	
used to initialize the current object as a new instance of the ctHuman type.	
Parameters	
1	**Aid: dtPhoneNumber** used to initialize the id field
2	**Akind: etHumanKind** used to initialize the kind field
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the system poststate includes the current object as a new ctHuman instance having its attributes equal to the ones provided as parameters.

The listing 5.20 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{if
4  (
5  /* Post F01 */
6  let Self:ctHuman in
7
8  Self.id = Aid
9  and Self.kind = Akind
10
11 /* Post F02 */
12 and (Self.oclIsNew and self = Self)
13 )
14 then (result = true)
15 else (result = false)
16 endif}
```

Listing 5.20: Messir (MCL-oriented) specification of the operation *init*.

5.13.2 Operation Model for isAcknowledged

The `isAcknowledged` operation has the following properties:

OPERATION	
isAcknowledged	
used to specify the property of having sent an alert acknowledge message to the human having declared the alert through its own communication company.	
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the message ieSmsSend is sent to the related input interface of the related communication company actor with the human phone number and the generic message 'The handling of your alert by our services is in progress !'

5.14 Primary Types - Operation Schemes for Class ctState

5.14.1 Operation Model for init

The `init` operation has the following properties:

Operation	
init	
used to initialize the current object as a new instance of the ctState type.	
Parameters	
1	**AnextValueForAlertID: dtInteger** used to initialize the nextValueForAlertID field
2	**AnextValueForCrisisID: dtInteger** used to initialize the nextValueForCrisisID field
3	**Aclock: dtDateAndTime** used to initialize the clock field
4	**AcrisisReminderPeriod: dtSecond** used to initialize the crisisReminderPeriod field
5	**AmaxCrisisReminderPeriod: dtSecond** used to initialize the maxCrisisReminderPeriod field
6	**AvpLastReminder: dtDateAndTime** used to initialize the vpLastReminder field
7	**AvpStarted: ptBoolean** used to initialize the vpStarted field
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the system poststate includes the current object as a new ctState instance having its attributes equal to the ones provided as parameters.

The listing 5.21 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{if
4  (
5  /* Post F01 */
6  let Self:ctState in
7
8  Self.nextValueForAlertID = AnextValueForAlertID
9  and Self.nextValueForCrisisID = AnextValueForCrisisID
10 and Self.clock = Aclock
11 and Self.crisisReminderPeriod = AcrisisReminderPeriod
12 and Self.maxCrisisReminderPeriod = AmaxCrisisReminderPeriod
13 and Self.vpLastReminder = AvpLastReminder
14 and Self.vpStarted = AvpStarted
15
16 and (Self.oclIsNew and self = Self)
17 )
18 then (result = true)
19 else (result = false)
```

```
20 endif}
```

Listing 5.21: Messir (MCL-oriented) specification of the operation *init*.

5.15 Primary Types - Operation Schemes for Datatype dtAlertID

5.15.1 Operation Model for is

The `is` operation has the following properties:

Operation	
is	
used to determine which strings are considered as valid alert identifiers.	
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	if the length of the value attribute of a dtAlertID is a ptInteger greater than zero and lower or equal to 20 then the operation returns the ptBoolean true, else the ptBoolean false.

The listing 5.22 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4     ( if
5      ( self.value.length().gt(0)
6       and self.value.length().leq(20)
7      )
8      then (TheResult = true)
9      else (TheResult = false)
10     endif
11     result = TheResult
12    )}
```

Listing 5.22: Messir (MCL-oriented) specification of the operation *is*.

5.16 Primary Types - Operation Schemes for Datatype dtComment

5.16.1 Operation Model for is

The `is` operation has the following properties:

Operation	
is	
used to determine which strings are considered as valid comments.	
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the length of the string value is not more than 160 characters.

The listing 5.23 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( MaxLength = 160
6        and self.value.length().leq(MaxLength)
7       )
8       then (TheResult = true)
9       else (TheResult = false)
10      endif
11      result = TheResult
12     )}
```

Listing 5.23: Messir (MCL-oriented) specification of the operation *is*.

5.17 Primary Types - Operation Schemes for Datatype dtCoordinatorID

5.17.1 Operation Model for is

The `is` operation has the following properties:

Operation	
is	
used to determine which string are considered as valid alert identifiers.	
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	if the length of the value attribute of a dtCoordinatorID is a ptInteger greater than zero and lower or equal to 5 than the operation returns the ptBoolean true, else the ptBoolean false.

The listing 5.24 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( self.value.length().gt(0)
6        and self.value.length().leq(5)
7       )
8       then (TheResult = true)
9       else (TheResult = false)
10      endif
11      result = TheResult
12     )}
```

Listing 5.24: Messir (MCL-oriented) specification of the operation *is*.

5.18 Primary Types - Operation Schemes for Datatype dtCrisisID

5.18.1 Operation Model for is

The `is` operation has the following properties:

Operation	
is	
used to determine which strings are considered as valid crisis identifiers.	
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	if the length of the value attribute of a dtCrisisID is a ptInteger greater than zero and lower or equal to 10 than the operation returns the ptBoolean true, else the ptBoolean false.

The listing 5.25 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( self.value.length().gt(0)
6        and self.value.length().leq(10)
7       )
8       then (TheResult = true)
9       else (TheResult = false)
10      endif
11      result = TheResult
12     )}
```

Listing 5.25: Messir (MCL-oriented) specification of the operation *is*.

5.19 Primary Types - Operation Schemes for Datatype dtGPSLocation

5.19.1 Operation Model for is

The `is` operation has the following properties:

Operation	
is	
used to determine which couples are considered as valid dtGPSLocation values.	
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true if both latitude and longitude are valid values according to their is operation.

The listing 5.26 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( self.latitude.is()
6        and self.longitude.is
7       )
8       then (TheResult = true)
9       else (TheResult = false)
10      endif
11      result = TheResult
12     )}
```

Listing 5.26: Messir (MCL-oriented) specification of the operation *is*.

5.19.2 Operation Model for isNearTo

The `isNearTo` operation has the following properties:

OPERATION	
isNearTo	
used to determine if locations are considered enough close to be treated as equivalent in the application domain context. In the context of the iCrash system, we compute the distance between two GPS locations using the following Haversine formula. (more details can be found at: http://www.movable-type.co.uk/scripts/latlong.html and http://www.gpsvisualizer.com/calculators#distance)	
Parameters	
1	**AGPSLocation: dtGPSLocation** the GPS location to be compared to.
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	if the Haversine formula (ACOS(SIN(lat1)*SIN(lat2)+COS(lat1)*COS(lat2)*COS(lon2-lon1))*6371, in which latitudes and longitudes are in radiansapplied to the two dtGPS coordinates is lower to 100 meters) then the predicate is true and false otherwise.

The listing 5.27 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in true
4      let EarthRadius: dtReal in
5      let MaxDistance: dtReal in
6      let ComparedLatitude: dtLatitude in
7      let ComparedLongitude: dtLongitude in
8      let R1: dtReal in let R1a: dtReal in
9      let R2: dtReal in let R2a: dtReal in
10
11     ( if
12      ( EarthRadius.value = 6371
13       and MaxDistance.value = 100
14
15       and self.latitude = ComparedLatitude
16       and self.longitude = ComparedLongitude
17       and self.latitude.sin() = R1a
18       and self.latitude.sin().mul(R1a) = R1
19       and self.latitude.cos() = R2a
```

```
20        and self.latitude.cos().mul(R2a) = R2
21
22        and self.longitude = ComparedLongitude
23        and self.longitude.sub(ComparedLongitude).cos().mul(R2)
24            .add(R1).acos().mul(EarthRadius).sub(MaxDistance)
25            .value.leq(0)
26       )
27       then (TheResult = true)
28       else (TheResult = false)
29       endif
30       result = TheResult
31      )}
```

Listing 5.27: Messir (MCL-oriented) specification of the operation *isNearTo*.

5.20 Primary Types - Operation Schemes for Datatype dtLatitude

5.20.1 Operation Model for is

The `is` operation has the following properties:

OPERATION
is   used to determine which strings are considered as valid dtLatitude.
Return type
ptBoolean
Post-Condition (functional)
PostF 1 is true if the value is a real in the interval [-90.0 , +90.0].

The listing 5.28 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( AdtValue.value.geq(-90.0)
6        and AdtValue.value.leq(+90.0)
7       )
8       then (TheResult = true)
9       else (TheResult = false)
10      endif
11      result = TheResult
12     )}
```

Listing 5.28: Messir (MCL-oriented) specification of the operation *is*.

5.21 Primary Types - Operation Schemes for Datatype dtLogin

5.21.1 Operation Model for is

The `is` operation has the following properties:

Operation
is
used to determine which strings are considered as valid dtLogin.
Return type
ptBoolean
Post-Condition (functional)
PostF 1 is true of the length of the string value is not more than 20 characters.

The listing 5.29 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      let MaxLength: ptInteger in
5      ( if
6       ( MaxLength = 20
7        and self.value.length().leq(MaxLength)
8       )
9       then (TheResult = true)
10      else (TheResult = false)
11      endif
12      result = TheResult
13     )}
```

Listing 5.29: Messir (MCL-oriented) specification of the operation *is*.

5.22 Primary Types - Operation Schemes for Datatype dtLongitude

5.22.1 Operation Model for is

The `is` operation has the following properties:

Operation
is
used to determine which strings are considered as valid dtLongitude.
Return type
ptBoolean
Post-Condition (functional)
PostF 1 is true if the value is a real in the interval [-180.0 , +180.0].

The listing 5.30 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( AdtValue.value.geq(-180.0)
6        and AdtValue.value.leq(+180.0)
7       )
```

```
8       then (TheResult = true)
9       else (TheResult = false)
10      endif
11      result = TheResult
12     )}
```

Listing 5.30: Messir (MCL-oriented) specification of the operation *is*.

5.23 Primary Types - Operation Schemes for Datatype dtPassword

5.23.1 Operation Model for is

The `is` operation has the following properties:

Operation
is
used to determine which strings are considered as valid dtPassword.
Return type
ptBoolean
Post-Condition (functional)
PostF 1 is true of the length of the string value is at least 6 characters long.

The listing 5.31 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      let MinLength: ptInteger in
5      ( if
6       ( MinLength = 6
7        and self.value.length().geq(MinLength)
8       )
9       then (TheResult = true)
10      else (TheResult = false)
11      endif
12      result = TheResult
13     )}
```

Listing 5.31: Messir (MCL-oriented) specification of the operation *is*.

5.24 Primary Types - Operation Schemes for Datatype dtPhoneNumber

5.24.1 Operation Model for is

The `is` operation has the following properties:

Operation
is
used to determine which strings are considered as valid dtPhoneNumber.
Return type

continues in next page . . .

. . . Operation table continuation

ptBoolean
Post-Condition (functional)
PostF 1 is true of the length of the string value is from 4 to 30 characters. No standard is applied !

The listing 5.32 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4    ( if
5     ( self.value.length().gt(4)
6      and self.value.length().leq(30)
7     )
8     then (TheResult = true)
9     else (TheResult = false)
10    endif
11    result = TheResult
12   )}
```

Listing 5.32: Messir (MCL-oriented) specification of the operation *is*.

5.25 Primary Types - Operation Schemes for Enumeration etAlertStatus

5.25.1 Operation Model for is

The `is` operation has the following properties:

OPERATION
is used to determine which litteral belongs to the enumeration.
Return type
ptBoolean
Post-Condition (functional)
PostF 1 true iff the value is equal to one of the following values: `pending, valid, invalid`

The listing 5.33 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( self = pending
6        or self = valid
7        or self = invalid
8       )
9       then (TheResult = true)
10      else (TheResult = false)
11      endif
```

```
12      result = TheResult
13     )}
```

Listing 5.33: Messir (MCL-oriented) specification of the operation *is*.

5.26 Primary Types - Operation Schemes for Enumeration etCrisisStatus

5.26.1 Operation Model for is

The `is` operation has the following properties:

OPERATION
is
used to determine which litteral belongs to the enumeration.
Return type
ptBoolean
Post-Condition (functional)
PostF 1 — true iff the value is equal to one of the following values: `pending`, `handled`, `solved`, `closed`.

The listing 5.34 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( self = pending
6        or self = handled
7        or self = solved
8        or self = closed
9       )
10      then (TheResult = true)
11      else (TheResult = false)
12      endif
13      result = TheResult
14     )}
```

Listing 5.34: Messir (MCL-oriented) specification of the operation *is*.

5.27 Primary Types - Operation Schemes for Enumeration etCrisisType

5.27.1 Operation Model for is

The `is` operation has the following properties:

OPERATION
is
used to determine which litteral belongs to the enumeration.

continues in next page . . .

. . . Operation table continuation

Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the value is equal to one of the following values: `small, medium, huge`

The listing 5.35 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( self = small
6        or self = medium
7        or self = huge
8       )
9       then (TheResult = true)
10      else (TheResult = false)
11      endif
12      result = TheResult
13     )}
```

Listing 5.35: Messir (MCL-oriented) specification of the operation *is*.

5.28 Primary Types - Operation Schemes for Enumeration etHumanKind

5.28.1 Operation Model for is

The `is` operation has the following properties:

OPERATION	
is used to determine which litteral belongs to the enumeration.	
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the value is equal to one of the following values: `witness,victim,anonym`

The listing 5.36 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      ( if
5       ( self = witness
6        or self = victim
7        or self = anonymous
8       )
9       then (TheResult = true)
```

```
10      else (TheResult = false)
11      endif
12      result = TheResult
13     )}
```

Listing 5.36: Messir (MCL-oriented) specification of the operation *is*.

5.29 Secondary Types - Operation Schemes for Classes

There are no elements in this category in the system analysed.

5.30 Secondary Types - Operation Schemes for Datatype dtSMS

5.30.1 Operation Model for is

The `is` operation has the following properties:

OPERATION
is
used to determine which strings are considered as valid comments
Return type
ptBoolean
Post-Condition (functional)
PostF 1 true iff the length of the string value is not more than 160 characters.

The listing 5.37 provides the Messir (MCL-oriented) specification of the operation.

```
1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4      let MaxLength: ptInteger in
5      ( if
6       ( MaxLength = 160
7        and self.value.length().leq(MaxLength)
8       )
9       then (TheResult = true)
10      else (TheResult = false)
11      endif
12      result = TheResult
13     )}
```

Listing 5.37: Messir (MCL-oriented) specification of the operation *is*.

5.31 Secondary Types - Operation Schemes for Enumerations

There are no elements in this category in the system analysed.

Chapter 6

Test Model(s)

6.1 Test Model for testcase01

this positive test case intends to verify the correctness of the execution of a simple instance of the `suDeployAndRun` use case.

6.1.1 Test Steps Specification

6.1.1.1 testcase01-ts01oeCreateSystemAndEnvironment-actMsrCreator.outactMsrCreator.oeCreateSy

The `testcase01-ts01oeCreateSystemAndEnvironment-actMsrCreator.outactMsrCreator.oeCreat` has the following properties:

Test Step	
ts01oeCreateSystemAndEnvironment This test step initializes the system state and environment.	
Test Sent Message	
TSM 1	**out:Creator** **sends to system** **actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment (AqtyComCompanies)**
Variables	
V 1	**Creator:icrash.environment.actMsrCreator** only actMsrtCreator actors can trigger the system and environment creation and initialization.
Constraints	
C 1	the number of communication company actor instances present in the environment is equal to four to represent all the communication companies available in Luxembourg.
Oracle Constraints	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.1 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   Creator:actMsrCreator
4   AqtyComCompanies: ptInteger
5  }
6
7  constraints{
8   AqtyComCompanies = 4
9  }
10
11 oracle{
12  constraints{
13   true
14  }
15 }
```

Listing 6.1: Messir (MCL-oriented) specification of the test step *testcase01-ts01oeCreateSystemAndEnvironment*.

6.1.1.2 testcase01-ts02oeSetClock-actActivator.outactActivator.oeSetClock

The `testcase01-ts02oeSetClock-actActivator.outactActivator.oeSetClock` has the following properties:

Test Step	
ts02oeSetClock test the update of the current time.	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actActivator.outactActivator.oeSetClock (ACurrentClock)**
Variables	
V 1	**TheActor:actActivator** proactive actor responsible of requesting the update of the system's clock.
Constraints	
C 1 C 2	TheActor is any instance existing in the current environment status. ACurrentClock is a fixed date equal to the 24th November 2017 at 15:20:00 using a 24-hours notation [1].
Oracle Constraints	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.2 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
```

[1] for more details see the ISO 8601 Data elements and interchange formats - Information interchange - Representation of dates and times - http://www.iso.org/iso/home/standards/iso8601.htm

```
5  }
6
7  constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 24
12  ACurrentClock.time.hour.value = 15
13  ACurrentClock.time.minute.value = 20
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18  constraints{
19   true
20  }
21 }
```

Listing 6.2: Messir (MCL-oriented) specification of the test step *testcase01-ts02oeSetClock*.

6.1.1.3 testcase01-ts03oeLogin-actAdministrator.outactAdministrator.oeLogin

The `testcase01-ts03oeLogin-actAdministrator.outactAdministrator.oeLogin` has the following properties:

Test Step	
ts03oeLogin	
test the authentified access of the administrator	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actAdministrator.outactAdministrator.oeLogin (AdtLogin, AdtPassword)**
Variables	
V 1	**TheActor:actAdministrator** an actAdministor actor as subtype of actAuthenticated can send oeLogin messages to the system.
Constraints	
C 1	TheActor is any `actAdministrator` instance existing in the environment. It is thus expected that there exist at least one.
C 2	AdtLogin has its value attribute equal to the primitive string 'icrashadmin' (which is the correct administrator login known by the system after the step one.)
C 3	AdtPassword has its value attribute equal to the primitive string '7WXC1359' (which is the correct administrator password known by the system after the step one.)
Oracle Constraints	
OC 1	the `AMessage` value is expected to be equal to the primitive string 'You are logged ! Welcome ...'
OC 2	TheActor receives from system ieMessage(AMessage)

The listing 6.3 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor : actAdministrator
4   AdtLogin:dtLogin
5   AdtPassword:dtPassword
6  }
7
8  constraints{
9   TheActor=TheSystem.rnactAdministrator->any2(true)
10  AdtLogin.value.eq('icrashadmin')
11  AdtPassword.value.eq('7WXC1359')
12 }
13
14 oracle{
15  variables{
16   AMessage:ptString
17  }
18  constraints{
19   AMessage = 'You are logged ! Welcome ...'
20   TheActor.inactAdministrator.ieMessage(AMessage)
21  }
22 }
```

Listing 6.3: Messir (MCL-oriented) specification of the test step *testcase01-ts03oeLogin*.

6.1.1.4 testcase01-ts04oeAddCoordinator-actAdministrator.outactAdministrator.oeAddCoordina

The `testcase01-ts04oeAddCoordinator-actAdministrator.outactAdministrator.oeAddCoor` has the following properties:

Test Step	
ts04oeAddCoordinator to test the add of a new coordinator by an administrator.	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actAdministrator.outactAdministrator.oeAddCoordinator (AdtCoordinatorID, AdtLogin, AdtPassword)**
Variables	
V 1	**TheActor:actAdministrator** actAdministor actors as being the only one allowed to add coordinators.
Constraints	
C 1	TheActor is any `actAdministrator` instance existing in the environment. It is expected that there exists at least one which is the same during all the test case.
C 2	AdtCoordinatorID is equal to 1 to set the new coordinator ID
C 3	AdtLogin has its value attribute equal to the primitive string 'steve' which is the ID defined for the new coordinator.
C 4	AdtPassword has its value attribute equal to the primitive string 'pwdMessirExcalibur2017' which is the password to be set for steve.
Oracle Constraints	
OC 1	the administrator should have been acknowledged for the adding of the new coordinator.

The listing 6.4 provides the Messir (MCL-oriented) specification of the test step.

```

variables{
 TheActor : actAdministrator
 AdtCoordinatorID : dtCoordinatorID
 AdtLogin:dtLogin
 AdtPassword:dtPassword
}

constraints{
 TheActor = TheSystem.rnactAdministrator->any2(true)
 AdtCoordinatorID.value.eq('1')
 AdtLogin.value.eq('steve')
 AdtPassword.value.eq('pwdMessirExcalibur2017')
}

oracle{
 constraints{
  TheActor.inactAdministrator.ieCoordinatorAdded()
 }
}
```

Listing 6.4: Messir (MCL-oriented) specification of the test step *testcase01-ts04oeAddCoordinator*.

6.1.1.5 testcase01-ts05oeLogout-actAdministrator.outactAdministrator.oeLogout

The `testcase01-ts05oeLogout-actAdministrator.outactAdministrator.oeLogout` has the following properties:

Test Step	
ts05oeLogout to test the loggout of a connected administrator.	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actAdministrator.outactAdministrator.oeLogout ()**
Variables	
V 1	**TheActor:actAdministrator** an actAdministor actor as subtype of actAuthenticated can send oeLogout messages to the system.
Constraints	
C 1	TheActor is any `actAdministrator` instance existing in the environment. It is expected that there exists at least one which is the same during all the test case.
Oracle Constraints	
OC 1	the `AMessage` value is expected to be equal to the primitive string 'You are logged out ! Good Bye ...'
OC 2	the administrator should have received the messahe AMessage.

The listing 6.5 provides the Messir (MCL-oriented) specification of the test step.

```

variables{
 TheActor : actAdministrator
}

constraints{
 TheActor = TheSystem.rnactAdministrator->any2(true)
}

oracle{
 variables{
  AMessage:ptString
 }
 constraints{
  AMessage = 'You are logged out ! Good Bye ...'
  TheActor.inactAdministrator.ieMessage(AMessage)
 }
}
```

Listing 6.5: Messir (MCL-oriented) specification of the test step *testcase01-ts05oeLogout*.

6.1.1.6 testcase01-ts06oeSetClock02-actActivator.outactActivator.oeSetClock

The `testcase01-ts06oeSetClock02-actActivator.outactActivator.oeSetClock` has the following properties:

Test Step	
ts06oeSetClock02 test the update of the current time.	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actActivator.outactActivator.oeSetClock (ACurrentClock)**
Variables	
V 1	**TheActor:icrash.environment.actActivator** proactive actors responsible of requesting the update of the system's clock.
Constraints	
C 1 C 2	TheActor is any instance existing in the current environment status. ACurrentClock is a fixed date equal to the 26th November 2017 at 10:15:00 using a 24-hours notation.
Oracle Constraints	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.6 provides the Messir (MCL-oriented) specification of the test step.

```

variables{
```

```
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5  }
6
7  constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 10
13  ACurrentClock.time.minute.value = 15
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18  constraints{
19   true
20  }
21 }
```

Listing 6.6: Messir (MCL-oriented) specification of the test step *testcase01-ts06oeSetClock02*.

6.1.1.7 testcase01-ts07oeAlert1-actComCompany.outactComCompany.oeAlert

The `testcase01-ts07oeAlert1-actComCompany.outactComCompany.oeAlert` has the following properties:

Test Step	
ts07oeAlert1 tests the declaration of a new alert functionality.	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actComCompany.outactComCompany.oeAlert (AetHumanKind, AdtDate, AdtTime, AdtPhoneNumber, AdtGPSLocation, AdtComment)**
Variables	
V 1	**TheActor:actComCompany** actComCompany actors transfer alert declaration messages.
Constraints	
C 1	TheActor is any instance existing in the current environment status. It is expected to exist at least one.
C 2	AetHumanKind is equal to witness
C 3	AdtDate is equal to the 26th of November 2017
C 4	AdtTime is equal to 10:10:16 using a 24-hours.
C 5	AdtPhoneNumber is equal to the ptString value '+3524666445252'.
C 6	AdtGPSLocation is equal to (49.627675 , 6.159590).
C 7	AdtComment is equal to '3 cars involved in an accident.'
Oracle Constraints	
OC 1	AdtSMS is equal to the ptString 'Your alert has been registered. We will handle it and keep you informed'.

continues in next page . . .

... Test Step table continuation

OC 2	AdtSMS is sent to the phone number AdtPhoneNumber using the communication company having sent the alert using its ieSmsSend input message.

The listing 6.7 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor : actComCompany
4   AetHumanKind:etHumanKind
5   AdtDate:dtDate
6   AdtTime:dtTime
7   AdtPhoneNumber:dtPhoneNumber
8   AdtGPSLocation:dtGPSLocation
9   AdtComment:dtComment
10  }
11
12 constraints{
13  TheActor = TheSystem.rnactComCompany->any2(true)
14  AetHumanKind = witness
15  AdtDate.year.value = 2017
16  AdtDate.month.value = 11
17  AdtDate.day.value = 26
18  AdtTime.hour.value = 10
19  AdtTime.minute.value = 10
20  AdtTime.second.value = 16
21  AdtPhoneNumber.value = '+3524666445252'
22  AdtGPSLocation.latitude.value = 49.627675
23  AdtGPSLocation.longitude.value = 6.159590
24  AdtComment.value = '3 cars involved in an accident.'
25 }
26
27 oracle{
28  variables{
29   AdtSMS:dtSMS
30  }
31  constraints{
32   AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
33   TheActor.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
34  }
35 }
```

Listing 6.7: Messir (MCL-oriented) specification of the test step *testcase01-ts07oeAlert1*.

6.1.1.8 testcase01-ts08oeSetClock03-actActivator.outactActivator.oeSetClock

The `testcase01-ts08oeSetClock03-actActivator.outactActivator.oeSetClock` has the following properties:

Test Step
ts08oeSetClock03 test the update of the current time.
Test Sent Message

continues in next page ...

... Test Step table continuation

TSM 1	**out:TheActor** **sends to system** **actActivator.outactActivator.oeSetClock (ACurrentClock)**
Variables	
V 1	**TheActor:actActivator** proactive actor responsible of requesting the update of the system's clock.
Constraints	
C 1 C 2	TheActor is any instance existing in the current environment status. ACurrentClock is a fixed date equal to the 26th November 2017 at 10:30:00 using a 24-hours notation.
Oracle Constraints	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.8 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5  }
6
7  constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 10
13  ACurrentClock.time.minute.value = 30
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18  constraints{
19   true
20  }
21 }
```

Listing 6.8: Messir (MCL-oriented) specification of the test step *testcase01-ts08oeSetClock03*.

6.1.1.9 testcase01-ts09oeSollicitateCrisisHandling-actActivator.outactActivator.oeSollicitateCrisisHan

The `testcase01-ts09oeSollicitateCrisisHandling-actActivator.outactActivator.oeSollicit` has the following properties:

Test Step
ts09oeSollicitateCrisisHandling test the proactive sollication to handle an alert.
Test Sent Message

continues in next page ...

... Test Step table continuation

TSM 1	**out:TheActor** **sends to system** **actActivator.outactActivator.oeSollicitateCrisisHandling** ()
Variables	
V 1	**TheActor:icrash.environment.actActivator** proactive actor responsible of triggering sollicitation functionality.
Constraints	
C 1	TheActor is any instance existing in the current environment status. It is expected to exist at least one.
Oracle Variables	
OV 1	**TheAdministrator:actAdministrator** actAdministrator actors can be sollicitated to handle alerts.
OV 2	**TheCoordinator:actCoordinator** actCoordinator actors can be sollicitated to handle alerts.
OV 3	**AMessageForCrisisHandlers:ptString** messages sent to sollicitated actors are of type ptString.
Oracle Constraints	
OC 1	TheAdministrator is any instance existing in the current environment status. It is expected to exist at least one.
OC 2	TheCoordinator is any instance existing in the current environment status. It is expected to exist at least one.
OC 3	AMessageForCrisisHandlers is equal to the ptString 'There are alerts pending since more than the defined delay. Please REACT !'
OC 4	TheCoordinator and TheAdministrator have received the message AMessageForCrisisHandlers.

The listing 6.9 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor : actActivator
4  }
5
6  constraints{
7   TheActor = TheSystem.rnactActivator->any2(true)
8  }
9
10 oracle{
11  variables{
12   TheAdministrator:actAdministrator
13   TheCoordinator:actCoordinator
14   AMessageForCrisisHandlers:ptString
15  }
16  constraints{
17   TheAdministrator = TheSystem.rnactAdministrator->any2(true)
18   TheCoordinator = TheSystem.rnactCoordinator->any2(true)
19   AMessageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
         REACT !'
20   TheAdministrator.inactAdministrator.ieMessage(AMessageForCrisisHandlers)
```

```
21    TheCoordinator.inactAdministrator.ieMessage(AMessageForCrisisHandlers)
22   }
23  }
```

Listing 6.9: Messir (MCL-oriented) specification of the test step *testcase01-ts09oeSollicitateCrisisHandling*.

6.1.1.10 testcase01-ts10oeLogin02-actAuthenticated.outactAuthenticated.oeLogin

The `testcase01-ts10oeLogin02-actAuthenticated.outactAuthenticated.oeLogin` has the following properties:

Test Step	
ts10oeLogin02 test the authentified access of the coordinator	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actAuthenticated.outactAuthenticated.oeLogin (AdtLogin, AdtPassword)**
Variables	
V 1	**TheActor:actCoordinator** an actCoordinator actor as subtype of actAuthenticated can send oeLogin messages to the system.
Constraints	
C 1	TheActor is any `actAdministrator` instance existing in the environment. It is thus expected that there exist at least one.
C 2	AdtLogin has its value attribute equal to the primitive string 'icrashadmin' (which is the correct administrator login known by the system after the step one.)
C 3	AdtPassword has its value attribute equal to the primitive string '7WXC1359' (which is the correct administrator password known by the system after the step one.)
Oracle Constraints	
OC 1	the `AMessage` value is expected to be equal to the primitive string 'You are logged ! Welcome ...'

The listing 6.10 provides the Messir (MCL-oriented) specification of the test step.

```

variables{
 TheActor : actCoordinator
 AdtLogin:dtLogin
 AdtPassword:dtPassword
}

constraints{
 TheActor = TheSystem.rnactCoordinator->select(a | a.rnctCoordinator.login.value.eq('steve'))->any2
     (true)
 AdtLogin.value.eq('steve')
 AdtPassword.value.eq('pwdMessirExcalibur2017')
```

```
12 }
13
14 oracle{
15  variables{
16   AMessage:ptString
17  }
18  constraints{
19   AMessage = 'You are logged ! Welcome ...'
20   TheActor.inactAuthenticated.ieMessage(AMessage)
21  }
22 }
```

Listing 6.10: Messir (MCL-oriented) specification of the test step *testcase01-ts10oeLogin02*.

6.1.1.11 testcase01-ts11oeGetCrisisSet-actCoordinator.outactCoordinator.oeGetCrisisSet

The `testcase01-ts11oeGetCrisisSet-actCoordinator.outactCoordinator.oeGetCrisisSet` has the following properties:

Test Step	
ts11oeGetCrisisSet cf. actor documentation	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actCoordinator.outactCoordinator.oeGetCrisisSet (AetCrisisStatus)**
Variables	
V 1	**TheActor:icrash.environment.actCoordinator** cf. actor documentation
V 2	**AetCrisisStatus:icrash.concepts.primarytypes.datatypes.etCrisisStatus** cf. actor documentation
V 3	**ActCrisis:icrash.concepts.primarytypes.classes.ctCrisis** cf. actor documentation
Constraints	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AetCrisisStatus value is pending
Oracle Constraints	
OC 1	ActCrisis is any ctCrisis instance that has been sent to TheActor.

The listing 6.11 provides the Messir (MCL-oriented) specification of the test step.

```
1
2 variables{
3  TheActor : actCoordinator
4  AetCrisisStatus : etCrisisStatus
5 }
6
7 constraints{
```

```
 TheActor=TheSystem.rnactCoordinator
       ->select(a | a.rnctCoordinator.login.value.eq('steve'))
       ->any2(true)
 AetCrisisStatus = pending
}

oracle{
 variables{
  ActCrisis:ctCrisis
 }
 constraints{
  TheActor.inactCoordinator.ieSendACrisis(ActCrisis)
 }
}
```

Listing 6.11: Messir (MCL-oriented) specification of the test step *testcase01-ts11oeGetCrisisSet*.

6.1.1.12 testcase01-ts12oeSetCrisisHandler-actCoordinator.outactCoordinator.oeSetCrisisHandler

The `testcase01-ts12oeSetCrisisHandler-actCoordinator.outactCoordinator.oeSetCrisisHand` has the following properties:

Test Step	
ts12oeSetCrisisHandler cf. actor documentation	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actCoordinator.outactCoordinator.oeSetCrisisHandler (AdtCrisisID)**
Variables	
V 1	**TheActor:icrash.environment.actCoordinator** cf. actor documentation
V 2	**TheComCompany:icrash.environment.actComCompany** cf. actor documentation
V 3	**TheCoordinator:icrash.environment.actCoordinator** cf. actor documentation
V 4	**AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID** cf. actor documentation
V 5	**AMessage:lu.uni.lassy.messir.libraries.primitives.ptString** cf. actor documentation
V 6	**AdtPhoneNumber:icrash.concepts.primarytypes.datatypes.dtPhoneNumber** cf. actor documentation
V 7	**AdtSMS:icrash.concepts.secondarytypes.datatypes.dtSMS** cf. actor documentation
V 8	**ActAlert:icrash.concepts.primarytypes.classes.ctAlert** cf. actor documentation
Constraints	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtCrisisID as a value of 1

continues in next page . . .

... Test Step table continuation

C 3	AMessage is the string 'You are now considered as handling the crisis !'
C 4	AdtPhoneNumber
C 5	AdtSMS has for value the string 'The handling of your alert by our services is in progress !'
Oracle Constraints	
OC 1	there is a communication company actor that received the message ieSmsSend(AdtPhoneNumber,AdtSMS)
OC 2	there is a coordinator actor that received an alert using the message ieSendAnAlert(ActAlert)

The listing 6.12 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5  }
6
7  constraints{
8   TheActor=TheSystem.rnactCoordinator
9         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10        ->any2(true)
11 }
12
13 oracle{
14  variables{
15   AMessage:ptString
16   AdtPhoneNumber:dtPhoneNumber
17   AdtSMS:dtSMS
18   ActAlert:ctAlert
19   TheComCompany: actComCompany
20   TheCoordinator:actCoordinator
21  }
22  constraints{
23   AMessage = 'You are now considered as handling the crisis !'
24   AdtSMS.value = 'The handling of your alert by our services is in progress !'
25   TheComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
26   TheCoordinator.inactCoordinator.ieSendAnAlert(ActAlert)
27   TheActor.inactAuthenticated.ieMessage(AMessage)
28  }
29 }
```

Listing 6.12: Messir (MCL-oriented) specification of the test step *testcase01-ts12oeSetCrisisHandler*.

6.1.1.13 testcase01-ts13oeSetClock04-actActivator.outactActivator.oeSetClock

The `testcase01-ts13oeSetClock04-actActivator.outactActivator.oeSetClock` has the following properties:

TEST STEP
ts13oeSetClock04 cf. actor documentation
Test Sent Message

continues in next page ...

... Test Step table continuation

TSM 1	**out:TheActor** **sends to system** **actActivator.outactActivator.oeSetClock (ACurrentClock)**
Variables	
V 1	**TheActor:icrash.environment.actActivator** cf. actor documentation
V 2	**ACurrentClock:lu.uni.lassy.messir.libraries.calendar.dtDateAndTime** cf. actor documentation
Constraints	
C 1	TheActor
C 2	ACurrentClock

The listing 6.13 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5  }
6
7  constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 10
13  ACurrentClock.time.minute.value = 45
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18  constraints{
19   true
20  }
21 }
```

Listing 6.13: Messir (MCL-oriented) specification of the test step *testcase01-ts13oeSetClock04*.

6.1.1.14 testcase01-ts14oeValidateAlert-actCoordinator.outactCoordinator.oeValidateAlert

The `testcase01-ts14oeValidateAlert-actCoordinator.outactCoordinator.oeValidateAlert` has the following properties:

Test Step
ts14oeValidateAlert cf. actor documentation
Test Sent Message

continues in next page ...

... Test Step table continuation

TSM 1	**out:TheActor** **sends to system** **actCoordinator.outactCoordinator.oeValidateAlert (AdtAlertID)**
Variables	
V 1	**TheActor:icrash.environment.actCoordinator** cf. actor documentation
V 2	**AdtAlertID:icrash.concepts.primarytypes.datatypes.dtAlertID** cf. actor documentation
V 3	**AMessage:lu.uni.lassy.messir.libraries.primitives.ptString** cf. actor documentation
Constraints	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtAlertID
C 3	AMessage
Oracle Constraints	
OC 1	

The listing 6.14 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor : actCoordinator
4   AdtAlertID : dtAlertID
5  }
6
7  constraints{
8   TheActor=TheSystem.rnactCoordinator
9         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10        ->any2(true)
11 }
12
13 oracle{
14  variables{
15   AMessage:ptString
16  }
17  constraints{
18   AMessage = 'The Alert is now declared as valid !'
19   TheActor.actAuthenticated.inactAuthenticated.ieMessage(AMessage)
20  }
21 }
```

Listing 6.14: Messir (MCL-oriented) specification of the test step *testcase01-ts14oeValidateAlert*.

6.1.1.15 testcase01-ts15oeAlert2-actComCompany.outactComCompany.oeAlert

The `testcase01-ts15oeAlert2-actComCompany.outactComCompany.oeAlert` has the following properties:

Test Step	
ts15oeAlert2 cf. actor documentation	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actComCompany.outactComCompany.oeAlert (AetHumanKind, AdtDate, AdtTime, AdtPhoneNumber, AdtGPSLocation, AdtComment)**
Variables	
V 1	**TheActor:icrash.environment.actComCompany** cf. actor documentation
V 2	**AetHumanKind:icrash.concepts.primarytypes.datatypes.etHumanKind** cf. actor documentation
V 3	**AdtDate:lu.uni.lassy.messir.libraries.calendar.dtDate** cf. actor documentation
V 4	**AdtTime:lu.uni.lassy.messir.libraries.calendar.dtTime** cf. actor documentation
V 5	**AdtPhoneNumber:icrash.concepts.primarytypes.datatypes.dtPhoneNumber** cf. actor documentation
V 6	**AdtGPSLocation:icrash.concepts.primarytypes.datatypes.dtGPSLocation** cf. actor documentation
V 7	**AdtComment:icrash.concepts.primarytypes.datatypes.dtComment** cf. actor documentation
V 8	**AdtSMS:icrash.concepts.secondarytypes.datatypes.dtSMS** cf. actor documentation
Constraints	
C 1	TheActor
C 2	AetHumanKind
C 3	AdtDate
C 4	AdtTime
C 5	AdtPhoneNumber
C 6	AdtGPSLocation
C 7	AdtComment
C 8	AdtSMS
Oracle Constraints	
OC 1	

The listing 6.15 provides the Messir (MCL-oriented) specification of the test step.

```
1
2 variables{
3  TheActor : actComCompany
4  AetHumanKind:etHumanKind
5  AdtDate:dtDate
6  AdtTime:dtTime
```

```
 7   AdtPhoneNumber:dtPhoneNumber
 8   AdtGPSLocation:dtGPSLocation
 9   AdtComment:dtComment
10  }
11
12  constraints{
13   TheActor = TheSystem.rnactComCompany->any2(true)
14   AetHumanKind = witness
15   AdtDate.year.value = 2017
16   AdtDate.month.value = 11
17   AdtDate.day.value = 26
18   AdtTime.hour.value = 10
19   AdtTime.minute.value = 20
20   AdtTime.second.value = 00
21   AdtPhoneNumber.value = '+3524666445000'
22   AdtGPSLocation.latitude.value = 49.627095
23   AdtGPSLocation.longitude.value = 6.160251
24   AdtComment.value = 'A car crash just happened.'
25  }
26
27  oracle{
28   variables{
29    AdtSMS:dtSMS
30   }
31   constraints{
32    AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
33    TheActor.actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
34   }
35  }
```

Listing 6.15: Messir (MCL-oriented) specification of the test step *testcase01-ts15oeAlert2*.

6.1.1.16 testcase01-ts16oeSetClock05-actActivator.outactActivator.oeSetClock

The `testcase01-ts16oeSetClock05-actActivator.outactActivator.oeSetClock` has the following properties:

Test Step	
ts16oeSetClock05 cf. actor documentation	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actActivator.outactActivator.oeSetClock (ACurrentClock)**
Variables	
V 1 V 2	**TheActor:icrash.environment.actActivator** cf. actor documentation **ACurrentClock:lu.uni.lassy.messir.libraries.calendar.dtDateAndTime** cf. actor documentation
Constraints	
C 1 C 2	TheActor ACurrentClock

The listing 6.16 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5  }
6
7  constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 12
13  ACurrentClock.time.minute.value = 45
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18  constraints{
19   true
20  }
21 }
```

Listing 6.16: Messir (MCL-oriented) specification of the test step *testcase01-ts16oeSetClock05*.

6.1.1.17 testcase01-ts17oeSetCrisisStatus-actCoordinator.outactCoordinator.oeSetCrisisStatus

The `testcase01-ts17oeSetCrisisStatus-actCoordinator.outactCoordinator.oeSetCrisisStatu` has the following properties:

Test Step	
ts17oeSetCrisisStatus cf. actor documentation	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actCoordinator.outactCoordinator.oeSetCrisisStatus (AdtCrisisID, AetCrisisStatus)**
Variables	
V 1	**TheActor:icrash.environment.actCoordinator** cf. actor documentation
V 2	**AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID** cf. actor documentation
V 3	**AetCrisisStatus:icrash.concepts.primarytypes.datatypes.etCrisisStatus** cf. actor documentation
V 4	**AMessage:lu.uni.lassy.messir.libraries.primitives.ptString** cf. actor documentation
Constraints	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtCrisisID

continues in next page . . .

... Test Step table continuation

C 3	AetCrisisStatus
C 4	AMessage
Oracle Constraints	
OC 1	

The listing 6.17 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5   AetCrisisStatus : etCrisisStatus
6  }
7
8  constraints{
9   TheActor=TheSystem.rnactCoordinator
10        ->select(a | a.rnctCoordinator.login.value.eq('steve'))
11        ->any2(true)
12 }
13
14 oracle{
15  variables{
16   AMessage:ptString
17  }
18  constraints{
19   AMessage = 'The crisis status has been updated !'
20   TheActor.inactAuthenticated.ieMessage(AMessage)
21  }
22 }
```

Listing 6.17: Messir (MCL-oriented) specification of the test step *testcase01-ts17oeSetCrisisStatus*.

6.1.1.18 testcase01-ts18oeReportOnCrisis-actCoordinator.outactCoordinator.oeReportOnCrisis

The `testcase01-ts18oeReportOnCrisis-actCoordinator.outactCoordinator.oeReportOnCri` has the following properties:

Test Step	
ts18oeReportOnCrisis cf. actor documentation	
Test Sent Message	
TSM 1	**out:TheActor** **sends to system** **actCoordinator.outactCoordinator.oeReportOnCrisis (AdtCrisisID, AdtComment)**
Variables	
V 1	**TheActor:icrash.environment.actCoordinator** cf. actor documentation
V 2	**AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID**

continues in next page ...

... Test Step table continuation

	cf. actor documentation
V 3	**AdtComment:icrash.concepts.primarytypes.datatypes.dtComment** cf. actor documentation
V 4	**AMessage:lu.uni.lassy.messir.libraries.primitives.ptString** cf. actor documentation
Constraints	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtCrisisID
C 3	AdtComment
C 4	AMessage
Oracle Constraints	
OC 1	

The listing 6.18 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5   AdtComment : dtComment
6  }
7
8  constraints{
9   TheActor=TheSystem.rnactCoordinator
10        ->select(a | a.rnctCoordinator.login.value.eq('steve'))
11        ->any2(true)
12 }
13
14 oracle{
15  variables{
16   AMessage:ptString
17  }
18  constraints{
19   AMessage = 'The crisis comment has been updated !'
20   TheActor.inactAuthenticated.ieMessage(AMessage)
21  }
22 }
```

Listing 6.18: Messir (MCL-oriented) specification of the test step *testcase01-ts18oeReportOnCrisis*.

6.1.1.19 testcase01-ts19oeCloseCrisis-actCoordinator.outactCoordinator.oeCloseCrisis

The `testcase01-ts19oeCloseCrisis-actCoordinator.outactCoordinator.oeCloseCrisis` has the following properties:

Test Step
ts19oeCloseCrisis cf. actor documentation
Test Sent Message

continues in next page ...

... Test Step table continuation

TSM 1	**out:TheActor** **sends to system** **actCoordinator.outactCoordinator.oeCloseCrisis (AdtCrisisID)**
Variables	
V 1	**TheActor:icrash.environment.actCoordinator** cf. actor documentation
V 2	**AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID** cf. actor documentation
V 3	**AMessage:lu.uni.lassy.messir.libraries.primitives.ptString** cf. actor documentation
Constraints	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtCrisisID
C 3	AMessage
Oracle Constraints	
OC 1	

The listing 6.19 provides the Messir (MCL-oriented) specification of the test step.

```
1
2  variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5  }
6
7  constraints{
8   TheActor=TheSystem.rnactCoordinator
9         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10        ->any2(true)
11 }
12
13 oracle{
14  variables{
15   AMessage:ptString
16  }
17  constraints{
18   AMessage = 'The crisis is now closed !'
19   TheActor.inactAuthenticated.ieMessage(AMessage)
20  }
21 }
```

Listing 6.19: Messir (MCL-oriented) specification of the test step *testcase01-ts19oeCloseCrisis*.

6.1.2 Test Case Instance - instance01

6.1.3 Test Case Instance - instance01Part01

Figure 6.1 Sequence diagram representing the first part of a simple and complete testcase instance for *iCrash* .

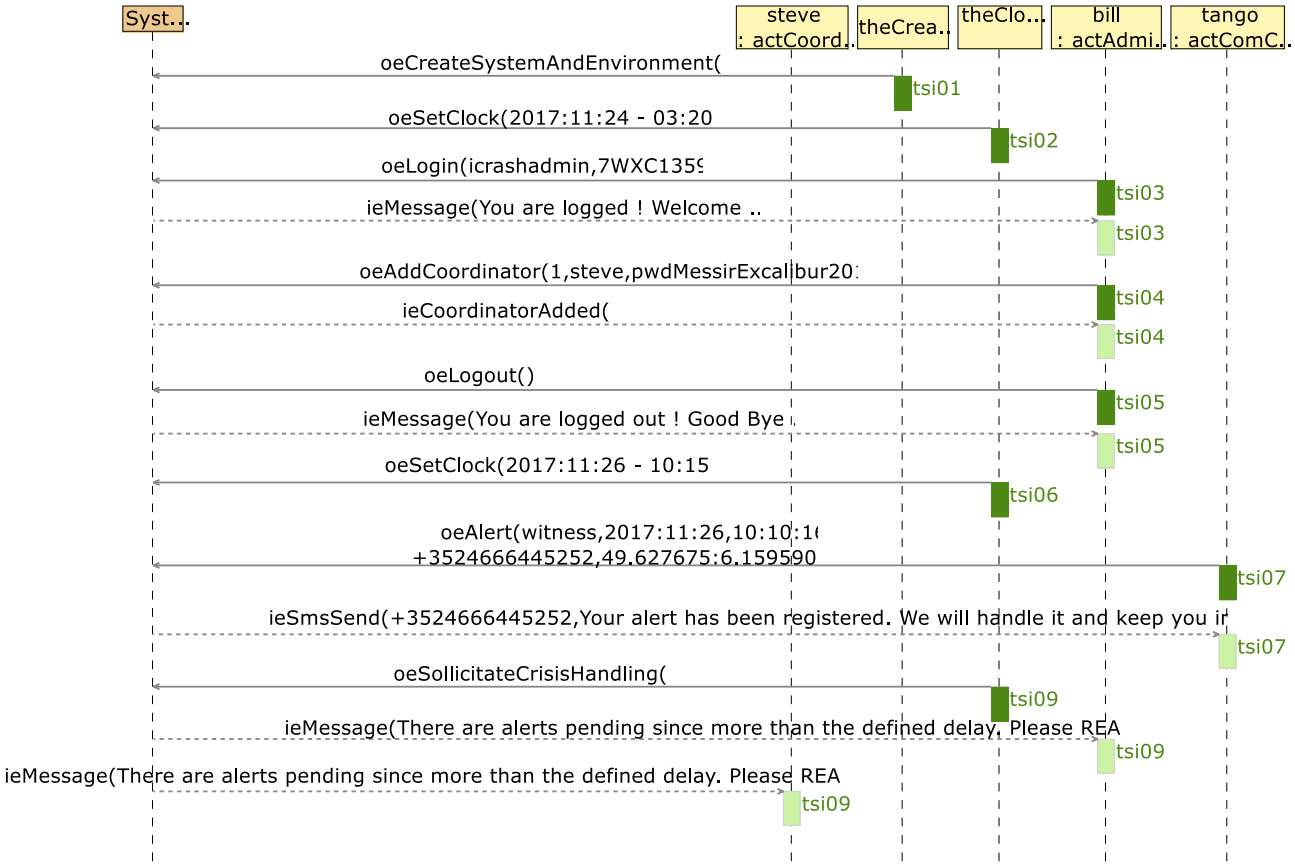


Figure 6.1: tci-testcase01-instance01-Part01 testcase instance sequence diagram

6.1.4 Test Case Instance - instance01Part02

Figure 6.2 Sequence diagram representing the second part of a simple and complete testcase instance for *iCrash* .

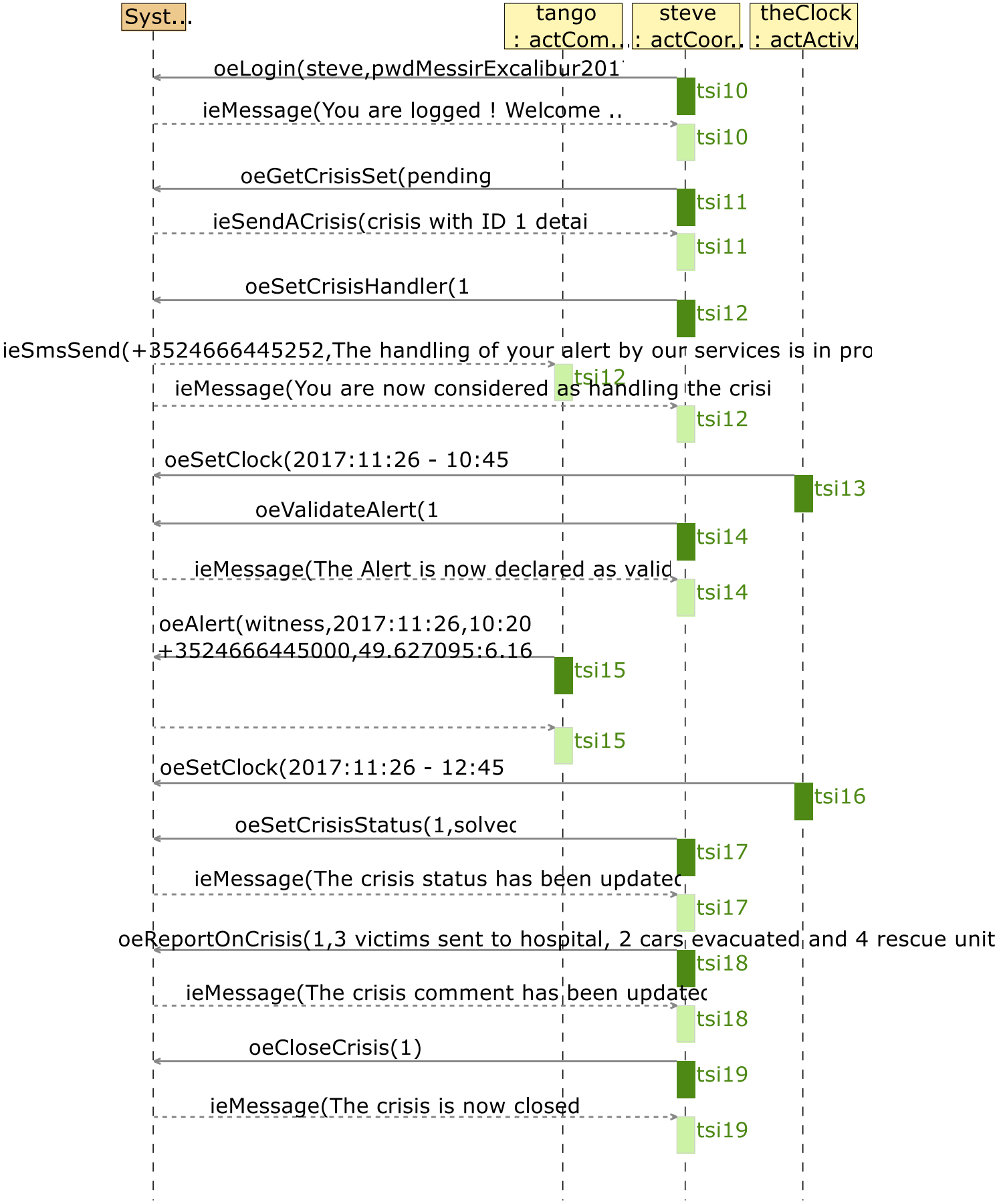


Figure 6.2: tci-testcase01-instance01-Part02 testcase instance sequence diagram

Chapter 7

Additional Constraints

7.1 Quality Constraints

Description of all the constraints that concern the required quality criteria according to their ISO definition [**?**].

7.1.1 Functional suitability

Constraints on the degree to which the product provides functions that meet stated and implied needs when the product is used under specified conditions.

7.1.1.1 Functional completeness

List of requirements on the degree to which the set of functions covers all the specified tasks and user objectives.

1. (to be filled)

7.1.1.2 Functional correctness

List of requirements on the degree to which the set of functions covers all the specified tasks and user objectives.

1. (to be filled)

7.1.1.3 Functional appropriateness

List of requirements on the degree to which the functions facilitate the accomplishment of specified tasks and objectives.

1. (to be filled)

7.1.2 Performance efficiency

Constraints on the performance relative to the amount of resources used under stated conditions

7.1.2.1 Time behaviour

List of requirements on the degree to which the response and processing times and throughput rates of a product or system, when performing its functions, meet requirements.

1. (to be filled)

7.1.2.2 Resource utilization

List of requirements on the degree to which the amounts and types of resources used by a product or system, when performing its functions, meet requirements.

1. (to be filled)

7.1.2.3 Capacity

List of requirements on the degree to which the maximum limits of a product or system parameter meet requirements.

1. (to be filled)

7.1.3 Compatibility

Constraints on the degree to which a product, system or component can exchange information with other products, systems or components, and/or perform its required functions, while sharing the same hardware or software environment.

7.1.3.1 Co-existence

List of requirements on the degree to which a product can perform its required functions efficiently while sharing a common environment and resources with other products, without detrimental impact on any other product.

1. (to be filled)

7.1.3.2 Interoperability

List of requirements on the degree to which two or more systems, products or components can exchange information and use the information that has been exchanged.

1. (to be filled)

7.1.4 Usability

Constraints on the usability degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

7.1.4.1 Appropriateness recognizability

List of requirements on the degree to which users can recognize whether a product or system is appropriate for their needs.

1. (to be filled)

7.1.4.2 Learnability

List of requirements on the degree to which a product or system can be used by specified users to achieve specified goals of learning to use the product or system with effectiveness, efficiency, freedom from risk and satisfaction in a specified context of use.

1. (to be filled)

7.1.4.3 Operability

List of requirements on the degree to which a product or system has attributes that make it easy to operate and control.

1. (to be filled)

7.1.4.4 User error protection

List of requirements on the degree to which a system protects users against making errors.

1. (to be filled)

7.1.4.5 User interface aesthetics

List of requirements on the degree to which a user interface enables pleasing and satisfying interaction for the user.

1. (to be filled)

7.1.4.6 Accessibility

List of requirements on the degree to which a product or system can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use.

1. (to be filled)

7.1.5 Reliability

Contraints on the degree to which a system, product or component performs specified functions under specified conditions for a specified period of time.

7.1.5.1 Maturity

List of requirements on the degree to which a system, product or component meets needs for reliability under normal operation.

1. (to be filled)

7.1.5.2 Availability

List of requirements on the degree to which a system, product or component is operational and accessible when required for use.

1. (to be filled)

7.1.5.3 Fault tolerance

List of requirements on the degree to which a system, product or component operates as intended despite the presence of hardware or software faults.

1. (to be filled)

7.1.5.4 Recoverability

List of requirements on the degree to which, in the event of an interruption or a failure, a product or system can recover the data directly affected and re-establish the desired state of the system.

1. (to be filled)

7.1.6 Security

Contraints on the degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization.

7.1.6.1 Confidentiality

List of requirements on the degree to which a product or system ensures that data are accessible only to those authorized to have access.

1. (to be filled)

7.1.6.2 Integrity

List of requirements on the degree to which a system, product or component prevents unauthorized access to, or modification of, computer programs or data.

1. (to be filled)

7.1.6.3 Non-repudiation

List of requirements on the degree to which actions or events can be proven to have taken place, so that the events or actions cannot be repudiated later.

1. (to be filled)

7.1.6.4 Accountability

List of requirements on the degree to which the actions of an entity can be traced uniquely to the entity.

1. (to be filled)

7.1.6.5 Authenticity

List of requirements on the degree to which the identity of a subject or resource can be proved to be the one claimed.

1. (to be filled)

7.1.7 Maintainability

Contraints on the degree of effectiveness and efficiency with which a product or system can be modified by the intended maintainers.

7.1.7.1 Modularity

List of requirements on the degree to which a system or computer program is composed of discrete components such that a change to one component has minimal impact on other components.

1. (to be filled)

7.1.7.2 Reusability

List of requirements on the degree to which an asset can be used in more than one system, or in building other assets.

1. (to be filled)

7.1.7.3 Analysability

List of requirements on the degree of effectiveness and efficiency with which it is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified.

1. (to be filled)

7.1.7.4 Modifiability

List of requirements on the degree to which a product or system can be effectively and efficiently modified without introducing defects or degrading existing product quality.

1. (to be filled)

7.1.7.5 Testability

List of requirements on the degree of effectiveness and efficiency with which test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met.

1. (to be filled)

7.1.8 Portability

Contraints on the degree of effectiveness and efficiency with which a system, product or component can be transferred from one hardware, software or other operational or usage environment to another.

7.1.8.1 Adaptability

List of requirements on the degree to which a product or system can effectively and efficiently be adapted for different or evolving hardware, software or other operational or usage environments.

1. (to be filled)

7.1.8.2 Installability

List of requirements on the degree of effectiveness and efficiency with which a product or system can be successfully installed and/or uninstalled in a specified environment.

1. (to be filled)

7.1.8.3 Replaceability

List of requirements on the degree to which a product can replace another specified software product for the same purpose in the same environment.

1. (to be filled)

7.2 Other Constraints

Any other unclassified constraints judged as required for the product under development.

Appendix A

Undocumented Messir Specification Elements

A.1 Undocumented Use Cases

A.1.1 Undocumented User-Goal Level Use Cases

- icrash.usecases.ugVictimSendFamilyNotification.ugVictimSendFamilyNotification
- icrash.usecases.ugWitnessSendFamilyNotification.ugWitnessSendFamilyNotification

A.1.2 Undocumented Subfunction Level Use Cases

- icrash.usecases.subfunctions.oeCreateAlert
- icrash.usecases.subfunctions.oeSendNotification
- icrash.usecases.subfunctions.oeUpdateCrisis
- icrash.usecases.subfunctions.ugSercurelyUserSystem

A.2 Undocumented Use Case Instances

A.2.1 Undocumented User-Goal Level Use Case Instances

- usecases.uciugSecurelyUseSystem.uciugSecurelyUseSystem

A.2.2 Undocumented Use Case Instance Views

- uci-uciugSecurelyUseSystem

A.3 Undocumented Actors

- icrash.environment.actDatabase
- icrash.environment.actSystem

A.4 Undocumented Environment Model Views

- em-view10
- em-view12

A.5 Undocumented Concept Model Views

- cm-pt-dt-lv-02-dtGPSLocation

A.6 Undocumented Operation Specifications

- icrash.environment.actAdministrator.outactAdministrator.ugAdministrateTheSystem
- icrash.environment.actSystem.outactSystem.oeChooseInformation
- icrash.environment.actSystem.outactSystem.oeSendNotification
- icrash.environment.actSystem.outactSystem.oeSendStatistic
- icrash.environment.actSystem.outactSystem.ugSercurelyUserSystem

A.7 Undocumented Test-Case Instance Specifications

- lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01.instance01
- lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01.instance01Part01
- lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01.instance01Part02

Appendix B

Specification project lu.uni.lassy.excalibur.examples.icrash

B.1 Use Cases Model

This section contains the use cases elicited during the requirements elicitation phase. The use cases are textually described as suggested by the Μεσσιρ method and inspired by the standard Cokburn template [?].

B.1.1 Use Cases

B.1.1.1 subfunction-oeCloseCrisis

the `actCoordinator`'s goal is to declare a crisis as closed.

USE-CASE DESCRIPTION	
Name	oeCloseCrisis
Scope	system
Level	subfunction
Primary actor(s)	
1	`actCoordinator[active]`
Goal(s) description	
the `actCoordinator`'s goal is to declare a crisis as closed.	
Protocol condition(s)	
1	the iCrash system has been deployed.
Pre-condition(s)	
1	none
Main post-condition(s)	
1	the crisis is know by the system to be closed.
2	a message `ieMessage(AMessage)` is sent to the `actCoordinator` to inform him that his crisis is now considered as closed.

Figure B.1 shows the use case diagram for the oeCloseCrisis subfunction use case

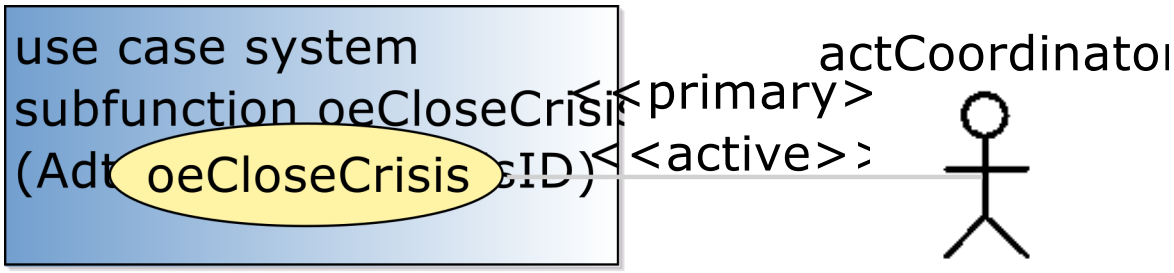


Figure B.1: oeCloseCrisis subfunction use case

Appendix C

Messir Specification Files Listing

C.1 File ./src-gen/messir-spec/.views.msr

```
//
//DON'T TOUCH THIS FILE !!!
//
package uuid7e0d382938204f3c9036c123484468fb {
 Concept Model {}
}
```

Listing C.1: Messir Spec. file .views.msr.

C.2 File ./src-gen/messir-spec/operations/concepts/secondarytypes-datatypes/dtSMS.msr

```
package icrash.operations.concepts.secondarytypes.datatypes.dtSMS{

import lu.uni.lassy.messir.libraries.primitives
import lu.uni.lassy.messir.libraries.calendar
import lu.uni.lassy.messir.libraries.math

import icrash.concepts.primarytypes.datatypes
import icrash.concepts.primarytypes.classes
import icrash.concepts.secondarytypes.datatypes
import icrash.concepts.secondarytypes.classes

Operation Model {
operation: icrash.concepts.secondarytypes.datatypes.dtSMS.is():ptBoolean{
  postF{
    let TheResult: ptBoolean in
    let MaxLength: ptInteger in
    ( if
     ( MaxLength = 160
      and self.value.length().leq(MaxLength)
     )
     then (TheResult = true)
     else (TheResult = false)
     endif
     result = TheResult
    )}
prolog{ "src/Operations/Concepts/SecondaryTypesDatatypes/SecondaryTypesDatatypes-dtSMS-is.pl"}
}
}
}
```

Listing C.2: Messir Spec. file dtSMS.msr.

C.3 File ./src-gen/messir-spec/operations/environment/environment-actActivator-oeSetClock.msr

```
package icrash.operations.environment.actActivator.oeSetClock {

import icrash.environment

import lu.uni.lassy.messir.libraries.primitives
import lu.uni.lassy.messir.libraries.calendar
import lu.uni.lassy.messir.libraries.math

import icrash.concepts.primarytypes.datatypes
import icrash.concepts.primarytypes.classes

 Operation Model {

operation: actActivator.outactActivator.oeSetClock(AcurrentClock:dtDateAndTime):ptBoolean
{
preP{
 let TheSystem: ctState in
 let AvpStarted: ptBoolean in

/* PreP01 */
 self.rnActor.rnSystem = TheSystem
 and self.rnActor.rnSystem.vpStarted = AvpStarted
 and AvpStarted = true
 and TheSystem.clock.lt(AcurrentClock)
}
preF{true}

postF{
 let TheSystem: ctState in
 self.rnActor.rnSystem = TheSystem

/* PostF01 */
 and TheSystem@post.clock = AcurrentClock
}
postP{true}

prolog{"src/Operations/Environment/OUT/outactActivator-oeSetClock.pl"}

}
}
}
```

Listing C.3: Messir Spec. file environment-actActivator-oeSetClock.msr.

C.4 File ./src-gen/messir-spec/operations/environment/environment-actActivator-oeSollicitateCrisisHandling.msr

```
package icrash.operations.environment.actActivator.oeSollicitateCrisisHandling {

import lu.uni.lassy.messir.libraries.primitives
import lu.uni.lassy.messir.libraries.math
import lu.uni.lassy.messir.libraries.string
import lu.uni.lassy.messir.libraries.calendar

import icrash.concepts.primarytypes.datatypes
import icrash.concepts.primarytypes.classes
import icrash.environment

Operation Model {

operation: actActivator.outactActivator.oeSollicitateCrisisHandling():ptBoolean
{
preP{
 let TheSystem: ctState in
```

```
18  let AvpStarted: ptBoolean in
19  let ColctCrisisToHandle:
20     Bag(ctCrisis) in
21
22  self.rnActor.rnSystem = TheSystem
23
24 /* PreP01 */
25  and TheSystem.vpStarted
26
27 /* PreP02 */
28  and TheSystem.rnctCrisis->select(handlingDelayPassed())
29    = ColctCrisisToHandle
30  and ColctCrisisToHandle->size().geq(1)
31 }
32 preF{true}
33
34 postF{
35  let TheSystem: ctState in
36  let AMessageForCrisisHandlers: dtComment in
37  let ColctCrisisToAllocateIfPossible:Bag(ctCrisis) in
38
39  self.rnActor.rnSystem = TheSystem
40 /* PostF01 */
41  and TheSystem.rnctCrisis->select(maxHandlingDelayPassed())
42    = ColctCrisisToAllocateIfPossible
43  and ColctCrisisToAllocateIfPossible->forAll(isAllocatedIfPossible())
44
45  /* PostF02 */
46  and TheSystem.rnctCrisis->select(handlingDelayPassed())
47  = ColctCrisisToHandle
48
49  and ColctCrisisToHandle->msrColSubtract(ColctCrisisToAllocateIfPossible)
50    = ColctCrisisToRemind
51
52  and if (ColctCrisisToRemind->size().geq(1))
53    then (AMessageForCrisisHandlers.value
54       ='There are alerts pending since more than the defined delay. Please REACT !'
55       and TheSystem.rnactAdministrator.
56         rnInterfaceIN^ieMessage(AMessageForCrisisHandlers)
57         and TheSystem.rnactCoordinator
58           ->forAll(rnInterfaceIN^ieMessage(AMessageForCrisisHandlers))
59       )
60    else true
61    endif
62 }
63 postP{
64  let TheSystem: ctState in
65  let TheClock: dtDateAndTime in
66
67  self.rnActor.rnSystem = TheSystem
68  and TheSystem.clock = TheClock
69  and TheSystem@post.vpLastReminder = TheClock
70 }
71
72 prolog{"src/Operations/Environment/OUT/outactActivator-oeSollicitateCrisisHandling.pl"}
73 }
74 }
75 }
```

Listing C.4: Messir Spec. file environment-actActivator-oeSollicitateCrisisHandling.msr.

C.5 File ./src-gen/messir-spec/operations/environment/environment-actAdministrator-oeAddCoordinator.msr

```
1 package icrash.operations.environment.actAdministrator.oeAddCoordinator {
2
3 import lu.uni.lassy.messir.libraries.primitives
4
```

```
5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7 import icrash.environment
8
9 Operation Model {
10
11 operation: actAdministrator.outactAdministrator.oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID,
      AdtLogin:dtLogin, AdtPassword:dtPassword):ptBoolean
12 {
13 preP{
14  let TheSystem: ctState in
15  let TheActor:actAdministrator in
16
17  self.rnActor.rnSystem = TheSystem
18  and self.rnActor = TheActor
19
20 /* PreP01 */
21  and TheSystem.vpStarted = true
22 /* PreP02 */
23  and TheActor.rnctAuthenticated.vpIsLogged = true
24  }
25 preF{
26  let TheSystem: ctState in
27  let TheActor:actAdministrator in
28  let ColctCoordinators:Bag(ctCoordinator) in
29
30  self.rnActor.rnSystem = TheSystem
31  and self.rnActor = TheActor
32 /* PreF01 */
33  and TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
34    = ColctCoordinators
35  and ColctCoordinators->isEmpty() = true
36   }
37 postF{
38  let TheSystem: ctState in
39  let TheactCoordinator:actCoordinator in
40  let ThectCoordinator:ctCoordinator in
41  self.rnActor.rnSystem = TheSystem
42  and self.rnActor = TheActor
43 /* PostF01 */
44  TheactCoordinator.init()
45 /* PostF02 */
46  and ThectCoordinator.init(AdtCoordinatorID,AdtLogin,AdtPassword)
47
48 /* PostF03 */
49  and TheactCoordinator@post.rnctCoordinator = ThectCoordinator
50
51 /* PostF04 */
52  and ThectCoordinator@post.rnactAuthenticated = TheactCoordinator
53
54 /* PostF05 */
55  and TheActor.rnInterfaceIN^ieCoordinatorAdded()
56 }
57 postP{true}
58
59 prolog{"src/Operations/Environment/OUT/outactAdministrator-oeAddCoordinator.pl"}
60 }
61 }
62 }
```

Listing C.5: Messir Spec. file environment-actAdministrator-oeAddCoordinator.msr.

C.6 File ./src-gen/messir-spec/operations/environment/environment-actAdministrator-oeDeleteCoordinator.msr

```
1 package icrash.operations.environment.actAdministrator.oeDeleteCoordinator {
2
3 import lu.uni.lassy.messir.libraries.primitives
```

```
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
7 import icrash.environment
8
9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11
12 Operation Model {
13
14 operation: actAdministrator.outactAdministrator.oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID
      ):ptBoolean
15 {
16 preP{
17  let TheSystem: ctState in
18  let TheActor:actAdministrator in
19
20  self.rnActor.rnSystem = TheSystem
21  and self.rnActor = TheActor
22
23 /* PreP01 */
24  and TheSystem.vpStarted = true
25 /* PreP02 */
26  and TheActor.rnctAuthenticated.vpIsLogged = true
27 }
28 preF{
29  let TheSystem: ctState in
30  let TheActor:actAdministrator in
31
32  self.rnActor.rnSystem = TheSystem
33  and self.rnActor = TheActor
34 /* PreF01 */
35  TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
36  = ColctCoordinators
37  and ColctCoordinators->size().eq(1)
38 }
39 postF{
40  let TheSystem: ctState in
41  let TheActor:actAdministrator in
42  let ThectCoordinator:ctCoordinator in
43  self.rnActor.rnSystem = TheSystem
44  and self.rnActor = TheActor
45 /* PostF01 */
46  TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
47  = ThectCoordinator
48  and ThectCoordinator.rnactCoordinator->forAll(msrIsKilled)
49  and ThectCoordinator.msrIsKilled
50
51  /* PostF02 */
52  and TheActor.rnInterfaceIN^ieCoordinatorDeleted()
53
54  /* Post Protocol:*/
55 /* PostP01 */
56  and true
57  }
58  postP{true}
59
60  prolog{"src/Operations/Environment/OUT/outactAdministrator-oeDeleteCoordinator.pl"}
61  }
62      }
63     }
```

Listing C.6: Messir Spec. file environment-actAdministrator-oeDeleteCoordinator.msr.

C.7 File ./src-gen/messir-spec/operations/environment/environment-actAuthenticated-oeCreateAlert.msr

```
1 package icrash.environment.operations.actAuthenticated.outactAuthenticated.oeCreateAlert {
```

```
 2
 3 import lu.uni.lassy.messir.libraries.primitives
 4 import lu.uni.lassy.messir.libraries.math
 5 import lu.uni.lassy.messir.libraries.string
 6 import lu.uni.lassy.messir.libraries.calendar
 7
 8 import icrash.environment
 9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11 import icrash.concepts.secondarytypes.datatypes
12
13  Operation Model {
14
15   operation: icrash.environment.actAuthenticated.outactAuthenticated.oeCreateAlert(AetHumanKind:
         etHumanKind,
16                         AdtDate:dtDate,
17                         AdtTime:dtTime,
18                         AdtPhoneNumber:dtPhoneNumber,
19                         AdtGPSLocation:dtGPSLocation,
20                         AdtComment:dtComment):ptBoolean{
21    // include below the specification information (pre,post or ocl or prolog)
22
23   }
24  }
25 }
```

Listing C.7: Messir Spec. file environment-actAuthenticated-oeCreateAlert.msr.

C.8 File ./src-gen/messir-spec/operations/environment/environment-actAuthenticated.msr

```
 1 package icrash.operations.environment.actAuthenticated{
 2
 3 import lu.uni.lassy.messir.libraries.primitives
 4
 5 import icrash.concepts.primarytypes.datatypes
 6 import icrash.concepts.primarytypes.classes
 7 import icrash.concepts.secondarytypes.datatypes
 8 import icrash.concepts.secondarytypes.classes
 9 import icrash.environment
10
11 Operation Model {
12
13 operation: actAuthenticated.outactAuthenticated.oeLogin(AdtLogin:dtLogin, AdtPassword:dtPassword):
       ptBoolean
14 {
15 preP{
16  let TheSystem: ctState in
17  let TheActor:actAuthenticated in
18  self.rnActor.rnSystem = TheSystem
19  and self.rnActor = TheActor
20
21 /* PreP01 */
22  and TheSystem.vpStarted = true
23 /* PreP02 */
24  and TheActor.rnctAuthenticated.vpIsLogged = false
25 }
26 preF{
27 /* PreF01 */
28 true
29 }
30 postF{
31  let TheSystem: ctState in
32  let TheactAuthenticated:actAuthenticated in
33
34  let AptStringMessageForTheactAuthenticated: ptString in
35  let AptStringMessageForTheactAdministrator:ptString in
36
```

```
37  self.rnActor.rnSystem = TheSystem
38  and self.rnActor = TheactAuthenticated
39
40  and /* PostF01 */
41    if (TheactAuthenticated.rnctAuthenticated.pwd
42      = AdtPassword
43      and TheactAuthenticated.rnctAuthenticated.login
44        = AdtLogin
45      )
46    then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
47       and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
48       )
49    else (AptStringMessageForTheactAuthenticated
50       .eq('Wrong identification information ! Please try again ...')
51       and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
52       and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
53       and TheSystem.rnactAdministrator
54         .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
55       )
56    endif
57 }
58 postP{
59  let TheSystem: ctState in
60  let TheactAuthenticated:actAuthenticated in
61
62  self.rnActor.rnSystem = TheSystem
63  and self.rnActor = TheactAuthenticated
64 /* PostP01 */
65  if (TheactAuthenticated.rnctAuthenticated.pwd = AdtPassword
66    and TheactAuthenticated.rnctAuthenticated.login = AdtLogin
67    )
68  then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
69  else true
70  endif
71 }
72 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogin.pl"}
73 }
74 /*-------------------------------------------------------------------------------*/
75
76 operation: actAuthenticated.outactAuthenticated.oeLogout():ptBoolean{
77
78 preP{
79  let TheSystem: ctState in
80  let TheActor:actAdministrator in
81  self.rnActor.rnSystem = TheSystem
82  and self.rnActor = TheActor
83
84 /* PreP01 */
85  and TheSystem.vpStarted = true
86 /* PreP02 */
87  and TheActor.rnctAuthenticated.vpIsLogged = true
88 }
89 preF{
90 /* PreF01 */
91 true
92 }
93 postF{
94  let TheSystem: ctState in
95  let TheactAuthenticated:actAuthenticated in
96  let AptStringMessageForTheactAuthenticated: ptString in
97
98  self.rnActor.rnSystem = TheSystem
99  and self.rnActor = TheactAuthenticated
100
101  /* PostF01 */
102  AptStringMessageForTheactAuthenticated.eq('You are logged out ! Good Bye ...')
103  and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
104 }
105 postP{
106  let TheSystem: ctState in
```

```
107  let TheactAuthenticated:actAuthenticated in
108
109  self.rnActor.rnSystem = TheSystem
110  and self.rnActor = TheactAuthenticated.asSet
111 /* PostP01 */
112  TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = false
113 }
114 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogout.pl"}
115 }
116 }
117 }
```

Listing C.8: Messir Spec. file environment-actAuthenticated.msr.

C.9 File ./src-gen/messir-spec/operations/environment/environment-actComCompany.msr

```
 1 // Do not add/remove lines because code is inserted in slides
 2
 3 package icrash.operations.environment.actComCompany{
 4
 5 import lu.uni.lassy.messir.libraries.primitives
 6 import lu.uni.lassy.messir.libraries.calendar
 7 import lu.uni.lassy.messir.libraries.math
 8
 9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11 import icrash.concepts.secondarytypes.datatypes
12
13 import icrash.environment
14
15 Operation Model {
16
17 operation: actComCompany.outactComCompany.oeAlert(
18  AetHumanKind:etHumanKind,
19  AdtDate:dtDate,
20  AdtTime:dtTime,
21  AdtPhoneNumber:dtPhoneNumber,
22  AdtGPSLocation:dtGPSLocation,
23  AdtComment:dtComment
24 ):ptBoolean{
25
26 preP{
27  let TheSystem: ctState in
28  self.rnActor.rnSystem = TheSystem
29
30 /* PreP01 */
31  and TheSystem.vpStarted = true
32 }
33 preF{
34  let TheSystem: ctState in
35  self.rnActor.rnSystem = TheSystem
36
37 /* PreF01 */
38  and (TheSystem.clock.date.gt(AdtDate)
39     or (TheSystem.clock.date.eq(AdtDate)
40       and TheSystem.clock.time.gt(AdtTime)
41      )
42    )
43 }
44 postF{
45  let TheSystem: ctState in
46
47  let ActHuman:ctHuman in
48  let TheactComCompany:actComCompany in
49  let ActAlert:ctAlert in
50  let AAlertInstant:dtDateAndTime in
51  let AetAlertStatus:etAlertStatus in
```

```
52  let ActAlertNearBy:ctAlert in
53  let ActCrisis:ctCrisis in
54  let AdtCrisisID:dtCrisisID in
55  let AetCrisisType:etCrisisType in
56  let AetCrisisStatus:etCrisisStatus in
57  let ACrisisInstant:dtDateAndTime in
58  let ACrisisdtComment:dtComment in
59  let AptStringMessage:ptString in
60  let AdtSMS:dtSMS in
61  let AdtAlertID:dtAlertID in
62
63  self.rnActor.rnSystem = TheSystem
64  and self.rnActor = TheactComCompany
65 /* PostF01 */
66  TheSystem.nextValueForAlertID=PrenextValueForAlertID
67  and PrenextValueForAlertID.add(1) = PostnextValueForAlertID
68  and TheSystem@post.nextValueForAlertID = PostnextValueForAlertID
69
70  /* PostF02 */
71 and AAlertInstant.date=AdtDate
72 and AAlertInstant.time=AdtTime
73
74 and AetAlertStatus=pending
75
76 and TheSystem.nextValueForAlertID.todtString().eq(AdtAlertID)
77
78 and ActAlert.init(AdtAlertID,
79          AetAlertStatus,
80          AdtGPSLocation,
81          AAlertInstant,
82          AdtComment)
83
84  /* PostF03 */
85 and TheSystem.rnctAlert.select(location.isNearTo(AdtGPSLocation)) = ColctAlertsNearBy
86 and if (ColctAlertsNearBy->size()=0)
87   then (TheSystem.nextValueForCrisisID = PrenextValueForCrisisID
88      and PrenextValueForCrisisID.add(1) = PostnextValueForCrisisID
89      and TheSystem@post.nextValueForCrisisID = PostnextValueForCrisisID
90      and TheSystem.nextValueForCrisisID.todtString().eq(AdtCrisisID)
91      and AdtCrisisType = small
92      and AetCrisisStatus = pending
93      and ACrisisInstant= AAlertInstant
94      and ACrisisdtComment = 'no reporting yet defined'
95      and ActCrisis.init( AdtCrisisID,
96                AdtCrisisType,
97                AetCrisisStatus,
98                AdtGPSLocation,
99                ACrisisInstant,
100               ACrisisdtComment)
101     )
102  else (ColctAlertsNearBy.rnTheCrisis->msrAny(true) = ActCrisis)
103  endif
104
105  /* PostF04 */
106 and ActAlert@post.rnTheCrisis = ActCrisis
107
108 /* PostF05 */
109 and TheSystem.rnctHuman->select(id.eq(AdtPhoneNumber)) = HumanCol1
110
111 and HumanCol1->select(kind.etEq(AetHumanKind)) = HumanCol2
112 and if (HumanCol2->msrIsEmpty)
113   then (ActHuman.init(AdtPhoneNumber,AetHumanKind)
114      and ActHuman@post.rnactComCompany = TheactComCompany
115      )
116   else (HumanCol2->any(true) = ActHuman)
117   endif
118
119  and ActHuman.rnSignaled->msrIncluding(ActAlert) = ColAlerts
120
121  and ActHuman@post.rnSignaled = ColAlerts
```

```
122
123 /* PostF06 */
124 AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
125 and TheactComCompany.rnInterfaceIN^ieSmsSend(AdtPhoneNumber,AdtSMS)
126 }
127  /* Post Protocol:*/
128 /* PostP01 */
129 postP{true}
130
131 prolog{"src/Operations/Environment/OUT/outactComCompany-oeAlert.pl"}
132 }
133 }
134 }
```

Listing C.9: Messir Spec. file environment-actComCompany.msr.

C.10 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeCloseCrisis.msr

```
1 package icrash.operations.environment.actCoordinator.oeCloseCrisis {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeCloseCrisis(AdtCrisisID:dtCrisisID):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeCloseCrisis.pl"}
14 }
15 }
16 }
```

Listing C.10: Messir Spec. file environment-actCoordinator-oeCloseCrisis.msr.

C.11 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeGetAlertsSet.msr

```
1 package icrash.operations.environment.actCoordinator.oeGetAlertsSet {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.datatypes
9 import icrash.environment
10
11 Operation Model {
12
13 operation: actCoordinator.outactCoordinator.oeGetAlertsSet(AetAlertStatus:etAlertStatus):ptBoolean{
14 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeGetAlertsSet.pl"}
15 }
16 }
17 }
```

Listing C.11: Messir Spec. file environment-actCoordinator-oeGetAlertsSet.msr.

C.12 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeGetCrisisSet.msr

```
1 package icrash.operations.environment.actCoordinator.oeGetCrisisSet {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeGetCrisisSet(AetCrisisStatus:etCrisisStatus):ptBoolean
       {
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeGetCrisisSet.pl"}
14 }
15 }
16 }
```

Listing C.12: Messir Spec. file environment-actCoordinator-oeGetCrisisSet.msr.

C.13 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeInvalidateAlert.msr

```
1 package icrash.operations.environment.actCoordinator.oeInvalidateAlert {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeInvalidateAlert(AdtAlertID:dtAlertID):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeInvalidateAlert.pl"}
14 }
15 }
16 }
```

Listing C.13: Messir Spec. file environment-actCoordinator-oeInvalidateAlert.msr.

C.14 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeReportOnCrisis.msr

```
1 package icrash.operations.environment.actCoordinator.oeReportOnCrisis {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeReportOnCrisis(AdtCrisisID:dtCrisisID, AdtComment:
       dtComment):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeReportOnCrisis.pl"}
14 }
15
16 }
17 }
```

Listing C.14: Messir Spec. file environment-actCoordinator-oeReportOnCrisis.msr.

C.15 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisHandler.msr

```
1 package icrash.operations.environment.actCoordinator.oeSetCrisisHandler {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.datatypes
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.secondarytypes.datatypes
11 import icrash.environment
12
13 Operation Model {
14
15 operation: actCoordinator.outactCoordinator.oeSetCrisisHandler(AdtCrisisID:dtCrisisID):ptBoolean{
16 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeSetCrisisHandler.pl"}
17 }
18
19 }
20 }
```

Listing C.15: Messir Spec. file environment-actCoordinator-oeSetCrisisHandler.msr.

C.16 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisStatus.msr

```
1 package icrash.operations.environment.actCoordinator.oeSetCrisisStatus {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeSetCrisisStatus(AdtCrisisID:dtCrisisID,
      AetCrisisStatus:etCrisisStatus):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeSetCrisisStatus.pl"}
14 }
15
16 }
17 }
```

Listing C.16: Messir Spec. file environment-actCoordinator-oeSetCrisisStatus.msr.

C.17 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisType.msr

```
1 package icrash.operations.environment.actCoordinator.oeSetCrisisType {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
```

```
12 operation: actCoordinator.outactCoordinator.oeSetCrisisType(AdtCrisisID:dtCrisisID, AetCrisisType:
       etCrisisType):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeSetCrisisType.pl"}
14 }
15
16 }
17 }
```

Listing C.17: Messir Spec. file environment-actCoordinator-oeSetCrisisType.msr.

C.18 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeUpdateCrisis.msr

```
1 package icrash.environment.operations.actCoordinator.outactCoordinator.oeUpdateCrisis {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.datatypes
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.secondarytypes.datatypes
11
12  Operation Model {
13
14   operation: icrash.environment.actCoordinator.outactCoordinator.oeUpdateCrisis(
15    AdtCrisisID:dtCrisisID,
16    AetAlertStatus:etAlertStatus,
17    AdtDate:dtDate,
18     AdtTime:dtTime,
19     AdtComment:dtComment
20   ):ptBoolean{
21
22    preP{
23     TheSystem.vpStarted = true
24    }
25
26    preF{
27      let TheSystem: ctState in
28     self.rnActor.rnCoordinator = TheCoordinator
29
30     and (TheSystem.clock.date.gt(AdtDate)
31         or (TheSystem.clock.date.eq(AdtDate)
32           and TheSystem.clock.time.gt(AdtTime)
33         )
34       )
35    }
36
37    postF{
38     let TheSystem: ctState in
39     let ActCrisis:ctCrisis in
40     let AdtCrisisID:dtCrisisID in
41     let AetCrisisType:etCrisisType in
42     let AetCrisisStatus:etCrisisStatus in
43     let ACrisisInstant:dtDateAndTime in
44     let ACrisisdtComment:dtComment in
45     let AptStringMessage:ptString in
46
47     self.rnActor.rnCoordinator = TheCoordinator
48
49     and ACrisisInstant.date = AdtDate
50     and ACrisisInstant.time = AdtTime
51
52     and ACrisisStatus = pending
53
54     and ActCrisis.update(
55      AetAlertStatus,
```

```
56      AdtDate,
57       AdtTimee,
58       AdtComment
59     )
60    }
61
62    postP{
63     true
64    }
65   }
66  }
67 }
```

Listing C.18: Messir Spec. file environment-actCoordinator-oeUpdateCrisis.msr.

C.19 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeValidateAlert.msr

```
1 package icrash.operations.environment.actCoordinator.oeValidateAlert {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeValidateAlert(AdtAlertID:dtAlertID):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeValidateAlert.pl"}
14 }
15
16 }
17 }
```

Listing C.19: Messir Spec. file environment-actCoordinator-oeValidateAlert.msr.

C.20 File ./src-gen/messir-spec/operations/environment/environment-actMsrCreator-init.msr

```
1 package icrash.operations.icrash.environment.actMsrCreator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.environment
5
6 Operation Model {
7
8 operation: actMsrCreator.init():ptBoolean{}
9 // generic operation provided by the simulator
10 }
11 }
```

Listing C.20: Messir Spec. file environment-actMsrCreator-init.msr.

C.21 File ./src-gen/messir-spec/operations/environment/environment-actMsrCreator-oeCreateSystemAndEnvironment.msr

```
1 package icrash.operations.environment.actMsrCreator.oeCreateSystemAndEnvironment{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
```

```
 7 import icrash.concepts.primarytypes.datatypes
 8 import icrash.concepts.primarytypes.classes
 9 import icrash.concepts.secondarytypes.datatypes
10 import icrash.concepts.secondarytypes.classes
11 import icrash.environment
12
13 Operation Model {
14
15 operation: actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger):
       ptBoolean
16 {preP{true}
17 preF{true}
18 postF{
19  let TheSystem: ctState in
20  let AactMsrCreator: actMsrCreator in
21  let AactAdministrator: actAdministrator in
22  let AnextValueForAlertID: dtInteger in
23  let AnextValueForCrisisID: dtInteger in
24  let Aclock: dtDateAndTime in
25  let AcrisisReminderPeriod: dtSecond in
26  let AmaxCrisisReminderPeriod: dtSecond in
27  let AvpStarted: ptBoolean in
28
29  /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
30  AnextValueForAlertID.value.eq(1)
31  and AnextValueForCrisisID.value.eq(1)
32  and Aclock.date.year.value = 1970
33  and Aclock.date.month.value = 01
34  and Aclock.date.day.value = 01
35  and Aclock.time.hour.value = 00
36  and Aclock.time.minute.value = 00
37  and Aclock.time.second.value = 00
38
39  and AcrisisReminderPeriod.value.eq(300)
40  and AmaxCrisisReminderPeriod.value.eq(1200)
41  and AvpStarted = true
42  and TheSystem.init(AnextValueForAlertID,
43            AnextValueForCrisisID,
44            Aclock,
45            AcrisisReminderPeriod,
46            AmaxCrisisReminderPeriod,
47            Aclock,
48            AvpStarted
49           )
50  /* PostF02*/
51  and AactMsrCreator.init()
52  /* PostF03 */
53  and let AactComCompanyCol: Bag(actComCompany) in
54  AactComCompanyCol->size() = AqtyComCompanies
55  AactComCompanyCol-> forAll(init())
56  /* PostF04*/
57  and AactAdministrator.init()
58  /* PostF05*/
59  and let AactActivator:actActivator in
60  AactActivator.init()
61 /* PostF06 */
62  and let ActAdministrator:ctAdministrator in
63    let AdtLogin:dtLogin in
64    let AdtPassword:dtPassword in
65    AdtLogin.value.eq('icrashadmin')
66    and AdtPassword.value.eq('7WXC1359')
67    and ActAdministrator.init(AdtLogin,AdtPassword)
68  /* PostF07*/
69  and ActAdministrator@post.rnactAuthenticated = AactAdministrator}
70 postP{true}
71
72 prolog{ "src/Operations/Environment/OUT/outactMsrCreator-oeCreateSystemAndEnvironment.pl"}
73
74 }
75 }
```

```
76
77 }
```

Listing C.21: Messir Spec. file environment-actMsrCreator-oeCreateSystemAndEnvironment.msr.

C.22 File ./src-gen/messir-spec/environment/environment.msr

```
1 package icrash.environment{
2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.concepts.primarytypes.classes
5 import icrash.concepts.secondarytypes.datatypes
6 import lu.uni.lassy.messir.libraries.primitives
7 import lu.uni.lassy.messir.libraries.math
8 import lu.uni.lassy.messir.libraries.calendar
9
10 Environment Model {
11
12  actor actMsrCreator role rnactMsrCreator cardinality [1..1] {
13
14   operation init():ptBoolean
15
16   input interface inactMsrCreator {
17   }
18   output interface outactMsrCreator {
19    operation oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger ):ptBoolean
20   }
21  }
22
23  actor actAdministrator
24      role rnactAdministrator
25      cardinality [1..1]
26      extends actAuthenticated {
27
28   operation init():ptBoolean
29
30   output interface outactAdministrator{
31
32    operation oeAddCoordinator(
33           AdtCoordinatorID:dtCoordinatorID ,
34           AdtLogin:dtLogin ,
35           AdtPassword:dtPassword ):ptBoolean
36
37    operation oeDeleteCoordinator(
38           AdtCoordinatorID:dtCoordinatorID ):ptBoolean
39
40    //Sam:
41    operation oeUserActivityStatistic() : ptBoolean
42    operation oeNumberOfCrisis() : ptBoolean
43    operation oeTimeOfTypeOfCrisis() : ptBoolean
44    operation ugAdministrateTheSystem() : ptBoolean
45    operation oeStatistic() : ptBoolean
46   }
47
48   input interface inactAdministrator{
49
50    operation ieCoordinatorAdded():ptBoolean
51    operation ieCoordinatorDeleted():ptBoolean
52
53    //Sam:
54    operation ieClickStatistic() : ptBoolean
55    operation ieStatistic() : ptBoolean
56    operation ieCallTimeAndCrisisNumber() : ptBoolean
57    }
58  }
59
60  actor actCoordinator
61      role rnactCoordinator
62      cardinality [0..*]
```

```
63      extends actAuthenticated{
64
65   operation init():ptBoolean
66
67   output interface outactCoordinator{
68    operation oeInvalidateAlert(AdtAlertID:dtAlertID ):ptBoolean
69    operation oeCloseCrisis(AdtCrisisID:dtCrisisID ):ptBoolean
70    operation oeGetAlertsSet(AetAlertStatus:etAlertStatus ):ptBoolean
71    operation oeGetCrisisSet(AetCrisisStatus:etCrisisStatus ):ptBoolean
72    operation oeSetCrisisHandler(AdtCrisisID:dtCrisisID ):ptBoolean
73    operation oeUpdateCrisis( AdtCrisisID:dtCrisisID,
74           AetAlertStatus:etAlertStatus,
75           AdtDate:dtDate,
76           AdtTime:dtTime,
77           AdtComment:dtComment
78            ):ptBoolean // Vlad
79    operation oeReportOnCrisis(
80           AdtCrisisID:dtCrisisID ,
81           AdtComment:dtComment
82           ):ptBoolean
83    operation oeSetCrisisStatus(
84           AdtCrisisID:dtCrisisID ,
85           AetCrisisStatus:etCrisisStatus
86           ):ptBoolean
87    operation oeSetCrisisType(
88                    AdtCrisisID:dtCrisisID ,
89                    AetCrisisType:etCrisisType
90                    ):ptBoolean
91    operation oeValidateAlert(AdtAlertID:dtAlertID ):ptBoolean
92
93   }
94
95   input interface inactCoordinator{
96    operation ieSendAnAlert(ActAlert:ctAlert ):ptBoolean
97    operation ieSendACrisis(ActCrisis:ctCrisis ):ptBoolean
98    }
99  }
100
101 actor actComCompany role rnactComCompany cardinality [0..*]{
102
103  operation init():ptBoolean
104
105  output interface outactComCompany{
106   operation oeAlert(
107          AetHumanKind:etHumanKind ,
108          AdtDate:dtDate ,
109          AdtTime:dtTime ,
110          AdtPhoneNumber:dtPhoneNumber ,
111          AdtGPSLocation:dtGPSLocation ,
112          AdtComment:dtComment
113          ):ptBoolean
114  }
115
116  input interface inactComCompany{
117   operation ieSmsSend(AdtPhoneNumber:dtPhoneNumber ,
118              AdtSMS:dtSMS
119              ):ptBoolean
120   }
121 }
122
123 actor actAuthenticated role rnactAuthenticated cardinality [0..*]{
124
125  operation init():ptBoolean
126
127  output interface outactAuthenticated{
128   operation oeLogin(AdtLogin:dtLogin , AdtPassword:dtPassword ):ptBoolean
129   operation oeLogout():ptBoolean
130
131   //Michel:
132   operation oeSubmitCaptcha(AdtResponse:dtCaptchaResponse):ptBoolean
```

```
133
134     //Vlad:
135     operation oeCreateAlert(AetHumanKind:etHumanKind ,
136           AdtDate:dtDate ,
137           AdtTime:dtTime ,
138           AdtPhoneNumber:dtPhoneNumber ,
139           AdtGPSLocation:dtGPSLocation ,
140           AdtComment:dtComment
141           ):ptBoolean
142
143    }
144
145    input interface inactAuthenticated{
146     operation ieMessage(AMessage:ptString):ptBoolean
147
148     //Michel:
149     operation ieConfirmCaptcha(ACaptcha:dtCaptcha):ptBoolean
150     }
151   }
152
153   actor actActivator[proactive] role rnactActivator cardinality [1..1]{
154
155    operation init():ptBoolean
156
157    output interface outactActivator{
158     proactive operation oeSollicitateCrisisHandling():ptBoolean
159     proactive operation oeSetClock(AcurrentClock:dtDateAndTime ):ptBoolean
160    }
161
162    input interface inactActivator{
163     }
164   }
165
166   //Michel:
167   actor actCaptchaGenerator role rnactCaptchaGenerator cardinality[1 .. 1] {
168    input interface inactCaptchaGenerator {
169     operation ieGenerateCaptcha():ptBoolean//Documented
170     operation ieValidateCaptcha(AResponse:dtCaptchaResponse):ptBoolean//Documented
171    }
172    output interface outactCaptchaGenerator {
173     operation oeSendCaptcha(AdtCaptcha:dtCaptcha):ptBoolean//Partly Documented
174    }
175   }
176
177   actor actMailingService role rnactMailingService cardinality[1 .. 1] {
178    input interface inactMailingService {
179     operation ieSendMail(AAddress:ptString, ATitle:ptString, AContent:ptString):ptBoolean
180    }
181    output interface outactMailingService {
182    }
183   }
184
185   actor actCaptchaValidator role rnactCaptchaValidator cardinality[1 .. 1] {
186    input interface inactCaptchaValidator {
187     operation ieVerifyCaptcha(AdtCaptchaResponse:dtCaptchaResponse):ptBoolean
188    }
189    output interface outactCaptchaValidator {
190     operation oeCaptchaInvalid(AdtCaptchaId:ptInteger):ptBoolean
191     operation oeCaptchaValid(AdtCaptchaId:ptInteger):ptBoolean
192    }
193   }
194
195   actor actSystem role rnactSystem cardinality[1 .. 1] {
196    input interface inactSystem {
197     operation ieCallTimeAndCrisisNumber() : ptBoolean
198     operation ieCallUserActivity() : ptBoolean
199     operation ieCallTypeWithTimeAverage() : ptBoolean
200    }
201    output interface outactSystem {
202     operation ugSercurelyUserSystem() : ptBoolean
```

```
203     operation oeChooseInformation() : ptBoolean
204     operation oeSendNotification() : ptBoolean
205     operation oeSendStatistic() : ptBoolean
206    }
207   }
208
209   actor actDatabase role rnactDatabase cardinality[1 .. 1] {
210    input interface inactDatabase {
211     operation ieCallTimeAndCrisisNumber() : ptBoolean
212     operation ieCallUserActivity() : ptBoolean
213     operation ieCallTypeWithTimeAverage() : ptBoolean
214     operation oeSendStatistic() : ptBoolean
215     operation oeStatistic() : ptBoolean
216    }
217    output interface outactDatabase {
218    }
219   }
220  }
221 }
```

Listing C.22: Messir Spec. file environment.msr.

C.23 File ./src-gen/messir-spec/concepts/primarytypes-associations.msr

```
1 package icrash.concepts.primarytypes.associations {
2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.concepts.primarytypes.classes
5 import icrash.environment
6 import lu.uni.lassy.messir.libraries.primitives
7
8  Concept Model {
9
10   Primary Types{
11
12 // Internal
13
14 association assctAlertctCrisis
15  ctAlert(rnAlerts)[1..*]
16  ctCrisis (rnTheCrisis)[1..1]
17
18 association assctAlertctHuman
19  ctAlert(rnSignaled)[1..*]
20  ctHuman (rnSignaler)[1..1]
21
22 association assctCrisisctCoordinator
23  ctCrisis(rnHandled)[0..*]
24  ctCoordinator(rnHandler)[0..1]
25
26 // With Actors
27
28    association assctHumanactComCompany
29       ctHuman(rnctHuman)[0..*]
30       actComCompany(rnactComCompany)[1..1]
31
32    association assctCoordinatoractCoordinator
33       ctCoordinator(rnctCoordinator)[1..1]
34       actCoordinator(rnactCoordinator)[1..1]
35
36    association assctAuthenticatedactAuthenticated
37       ctAuthenticated(rnctAuthenticated)[1..1]
38       actAuthenticated(rnactAuthenticated)[1..1]
39
40   }
41  }
42 }
```

Listing C.23: Messir Spec. file primarytypes-associations.msr.

C.24 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctAdministrator.msr

```
1 package icrash.operations.concepts.primarytypes.classes.ctAdministrator{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7
8 Operation Model {
9
10 operation: icrash.concepts.primarytypes.classes.ctAdministrator.init(
11  Alogin:dtLogin ,
12  Apwd:dtPassword
13  ):ptBoolean{
14 postF{
15 if
16 (
17 let Self:ctAdministrator in
18 /* Post F01 */
19 Self.login(Alogin)
20 and Self.pwd = Apwd
21 and Self.vpIsLogged = false
22
23 /* Post F02 */
24 and (Self.oclIsNew and self = Self)
25 )
26 then (result = true)
27 else (result = false)
28 endif
29 }
30 prolog{ "src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAdministrator-init.pl"}
31  }
32 }
33 }
```

Listing C.24: Messir Spec. file primarytypes-classes-ctAdministrator.msr.

C.25 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctAlert.msr

```
1 package icrash.operations.concepts.primarytypes.classes.ctAlert{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.calendar
5
6 import icrash.concepts.primarytypes.datatypes
7 import icrash.concepts.primarytypes.classes
8
9 import icrash.environment
10
11 Operation Model {
12
13 operation: icrash.concepts.primarytypes.classes.ctAlert.init(Aid:dtAlertID , Astatus:etAlertStatus ,
       Alocation:dtGPSLocation , Ainstant:dtDateAndTime , Acomment:dtComment
14 ):ptBoolean{
15 postF{
16 if
17 (
18 /* Post F01 */
19 let Self:ctAlert in
20 Self.id = Aid
21 and Self.status = Astatus
22 and Self.location = Alocation
23 and Self.instant = Ainstant
```

```
24 and Self.comment = Acomment
25 /* Post F02 */
26 and (Self.oclIsNew and self = Self)
27 )
28 then (result = true)
29 else (result = false)
30 endif
31 }
32 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAlert-init.pl"}
33 }
34
35 operation: icrash.concepts.primarytypes.classes.ctAlert.isSentToCoordinator(AactCoordinator:
       actCoordinator ):ptBoolean
36 {
37 postF{
38 if
39 (
40 /* Post F01 */
41 AactCoordinator.rnInterfaceIN.ieSendAnAlert(self)
42 )
43 then (result = true)
44 else (result = false)
45 endif
46 }
47 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAlert-isSentToCoordinator.
       pl"}
48
49 }
50 }
51 }
```

Listing C.25: Messir Spec. file primarytypes-classes-ctAlert.msr.

C.26 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctAuthenticated.msr

```
1 package icrash.operations.concepts.primarytypes.classes.ctAuthenticated {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5 import icrash.concepts.primarytypes.classes
6
7 Operation Model {
8
9 operation: icrash.concepts.primarytypes.classes.ctAuthenticated.init(Alogin:dtLogin, Apwd:dtPassword
       ):ptBoolean{
10 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAuthenticated-init.pl"}
11 }
12 }
13
14 }
```

Listing C.26: Messir Spec. file primarytypes-classes-ctAuthenticated.msr.

C.27 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctCoordinator.msr

```
1 package icrash.operations.concepts.primarytypes.classes.ctCoordinator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5 import icrash.concepts.primarytypes.classes
6
7 Operation Model {
8
```

```
operation: icrash.concepts.primarytypes.classes.ctCoordinator.init(Aid:dtCoordinatorID, Alogin:
    dtLogin, Apwd:dtPassword):ptBoolean
{
postF{
if
(
/* Post F01 */
let Self:ctCoordinator in
Self.id = Aid
and Self.login = Alogin
and Self.pwd = Apwd
and Self.vpIsLogged = false
/* Post F02 */
and (Self.oclIsNew and self = Self)
)
then (result = true)
else (result = false)
endif}
prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCoordinator-init.pl"}
}
}
}
```

Listing C.27: Messir Spec. file primarytypes-classes-ctCoordinator.msr.

C.28 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctCrisis.msr

```
package icrash.operations.concepts.primarytypes.classes.ctCrisis {

import lu.uni.lassy.messir.libraries.primitives
import lu.uni.lassy.messir.libraries.math
import lu.uni.lassy.messir.libraries.calendar

import icrash.concepts.primarytypes.datatypes
import icrash.concepts.primarytypes.classes
import icrash.concepts.secondarytypes.datatypes
import icrash.concepts.secondarytypes.classes
import lu.uni.lassy.messir.libraries.primitives

import icrash.environment

Operation Model {
//-------------------------------------------------------------
operation: icrash.concepts.primarytypes.classes.ctCrisis.init(
        Aid:dtCrisisID,
        Atype:etCrisisType,
        Astatus:etCrisisStatus,
        Alocation:dtGPSLocation,
        Ainstant:dtDateAndTime,
        Acomment:dtComment
       ):ptBoolean{
postF{
if
(
/* Post F01 */
let Self:ctCrisis in
Self.id = Aid
and Self.type = Atype
and Self.status = Astatus
and Self.location = Alocation
and Self.instant = Ainstant
and Self.comment = Acomment
/* Post F02 */
and (Self.oclIsNew and self = Self)
)
then (result = true)
else (result = false)
```

```
41 endif}
42 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-init.pl"}}
43 //-------------------------------------------------------------
44 operation: icrash.concepts.primarytypes.classes.ctCrisis.handlingDelayPassed():ptBoolean
45 {
46 postF{
47 let TheSystem:ctState in
48 let CurrentClockSecondsQty:dtInteger in
49 let vpLastReminderSecondsQty:dtInteger in
50 let CrisisReminderPeriod:dtSecond in
51 if
52 ( /* Post F01 */
53  self.rnSystem = TheSystem
54  and self.status = pending
55  and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
56  and TheSystem.vpLastReminder.toSecondsQty() = vpLastReminderSecondsQty
57  and TheSystem.crisisReminderPeriod = CrisisReminderPeriod
58  and CurrentClockSecondsQty.sub(vpLastReminderSecondsQty).gt(CrisisReminderPeriod) = true
59 )
60 then (result = true)
61 else (result = false)
62 endif
63 }
64 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-handlingDelayPassed
       .pl"}}
65 //-------------------------------------------------------------
66 operation: icrash.concepts.primarytypes.classes.ctCrisis.maxHandlingDelayPassed():ptBoolean
67 {
68 postF{
69 let TheSystem:ctState in
70 let CurrentClockSecondsQty:dtInteger in
71 let CrisisInstantSecondsQty:dtInteger in
72 let MaxCrisisReminderPeriod:dtSecond in
73 if
74 ( /* Post F01 */
75  self.rnSystem = TheSystem
76  and self.status = pending
77  and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
78  and Self.instant.toSecondsQty() = CrisisInstantSecondsQty
79  and TheSystem.maxCrisisReminderPeriod = MaxCrisisReminderPeriod
80  and CurrentClockSecondsQty.sub(CrisisInstantSecondsQty)
81                .gt(MaxCrisisReminderPeriod)
82 )
83 then (result = true)
84 else (result = false)
85 endif
86 }
87 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-
       maxHandlingDelayPassed.pl"}}
88 //-------------------------------------------------------------
89 operation: icrash.concepts.primarytypes.classes.ctCrisis.isSentToCoordinator(AactCoordinator:
       actCoordinator):ptBoolean
90 {
91 postF{
92 if
93 (
94 /* Post F01 */
95  AactCoordinator.rnInterfaceIN.ieSendACrisis(self)
96 )
97 then (result = true)
98 else (result = false)
99 endif}
100 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-isSentToCoordinator
       .pl" }}
101 //-------------------------------------------------------------
102 operation: icrash.concepts.primarytypes.classes.ctCrisis.isAllocatedIfPossible():ptBoolean
103 {
104 postF{
105 if (
106 /* Post F01 */
```

```
107 self.maxHandlingDelayPassed()
108 and
109  if (TheSystem.rnactCoordinator->msrIsEmpty = false)
110  then (
111    /* Post F02 */
112    TheSystem.rnactCoordinator->msrAny(true) = TheCoordinatorActor
113    and TheCoordinatorActor.rnctCoordinator = TheCoordinator
114    and self@post.rnHandler = TheCoordinator
115    and self@post.status = handled
116    and self.id.value = TheCrisisIDptString
117    and 'You are now considered as handling the crisis having ID: '
118      .ptStringConcat(TheCrisisIDptString) = TheMessage
119     and TheCoordinatorActor.rnInterfaceIN^ieMessage(TheMessage)
120   )
121  else ( /* Post F03 */
122     TheSystem.rnactAdministrator
123     ->forAll(rnInterfaceIN.ieMessage('Please add new coordinators to handle pending crisis !'))
124   )
125  endif
126  )
127 then (result = true)
128 else (result = false)
129 endif
130 }
131 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-
      isAllocatedIfPossible.pl"}
132 }
133 }
134 }
```

Listing C.28: Messir Spec. file primarytypes-classes-ctCrisis.msr.

C.29 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctHuman.msr

```
 1 package icrash.operations.concepts.primarytypes.classes.ctHuman.init {
 2
 3 import lu.uni.lassy.messir.libraries.primitives
 4 import icrash.concepts.primarytypes.datatypes
 5
 6 import icrash.concepts.primarytypes.classes
 7
 8 Operation Model {
 9
10 operation: icrash.concepts.primarytypes.classes.ctHuman.init(Aid:dtPhoneNumber, Akind:etHumanKind):
      ptBoolean
11 {
12 postF{
13 if
14 (
15 /* Post F01 */
16 let Self:ctHuman in
17
18 Self.id = Aid
19 and Self.kind = Akind
20
21 /* Post F02 */
22 and (Self.oclIsNew and self = Self)
23 )
24 then (result = true)
25 else (result = false)
26 endif
27 }
28 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctHuman-init.pl"}
29 }
30 operation: icrash.concepts.primarytypes.classes.ctHuman.isAcknowledged():ptBoolean{
31 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctHuman-isAcknowledged.pl"}
32 }
```

```
33 }
34 }
```

Listing C.29: Messir Spec. file primarytypes-classes-ctHuman.msr.

C.30 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctState.msr

```
1 package icrash.operations.concepts.primarytypes.classes.ctState{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.calendar
5 import lu.uni.lassy.messir.libraries.math
6
7 import icrash.concepts.primarytypes.classes
8
9 Operation Model {
10
11  operation: icrash.concepts.primarytypes.classes.ctState.init(
12   AnextValueForAlertID: dtInteger,
13   AnextValueForCrisisID: dtInteger ,
14   dtAclock:dtDateAndTime,
15   AcrisisReminderPeriod: dtSecond,
16   AmaxCrisisReminderPeriod: dtSecond ,
17   AvpLastReminder: dtDateAndTime ,
18   AvpStarted:ptBoolean ):ptBoolean{
19 postF{
20 if
21 (
22 /* Post F01 */
23 let Self:ctState in
24
25 Self.nextValueForAlertID = AnextValueForAlertID
26 and Self.nextValueForCrisisID = AnextValueForCrisisID
27 and Self.clock = Aclock
28 and Self.crisisReminderPeriod = AcrisisReminderPeriod
29 and Self.maxCrisisReminderPeriod = AmaxCrisisReminderPeriod
30 and Self.vpLastReminder = AvpLastReminder
31 and Self.vpStarted = AvpStarted
32
33 and (Self.oclIsNew and self = Self)
34 )
35 then (result = true)
36 else (result = false)
37 endif
38 }
39 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctState-init.pl" }
40  }
41  }
42 }
```

Listing C.30: Messir Spec. file primarytypes-classes-ctState.msr.

C.31 File ./src-gen/messir-spec/concepts/primarytypes-classes.msr

```
1 package icrash.concepts.primarytypes.classes {
2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.environment
5 import lu.uni.lassy.messir.libraries.primitives
6 import lu.uni.lassy.messir.libraries.math
7 import lu.uni.lassy.messir.libraries.calendar
8
9  Concept Model {
10
11   Primary Types{
12
```

```
13  state class ctState {
14   attribute nextValueForAlertID:dtInteger
15   attribute nextValueForCrisisID:dtInteger
16   attribute clock:dtDateAndTime
17   attribute crisisReminderPeriod:dtSecond
18   attribute maxCrisisReminderPeriod:dtSecond
19   attribute vpLastReminder:dtDateAndTime
20   attribute vpStarted:ptBoolean
21
22   operation init( AnextValueForAlertID:dtInteger,
23           AnextValueForCrisisID:dtInteger,
24            Aclock:dtDateAndTime,
25           AcrisisReminderPeriod:dtSecond ,
26           AmaxCrisisReminderPeriod:dtSecond ,
27           AvpLastReminder:dtDateAndTime ,
28           AvpStarted:ptBoolean ): ptBoolean
29  }
30
31  class ctAlert role rnctAlert cardinality [0..*]{
32   attribute id:dtAlertID
33   attribute status: etAlertStatus
34   attribute location:dtGPSLocation
35   attribute instant:dtDateAndTime
36   attribute comment:dtComment
37
38   operation init(    Aid:dtAlertID ,
39         Astatus:etAlertStatus ,
40         Alocation:dtGPSLocation ,
41         Ainstant:dtDateAndTime ,
42         Acomment:dtComment ):ptBoolean
43   operation isSentToCoordinator(AactCoordinator:actCoordinator ):ptBoolean
44
45  }
46
47  class ctCrisis role rnctCrisis cardinality [0..*]{
48   attribute id:dtCrisisID
49   attribute type:etCrisisType
50   attribute status: etCrisisStatus
51   attribute location:dtGPSLocation
52   attribute instant:dtDateAndTime
53   attribute comment:dtComment
54
55   operation init(
56         Aid:dtCrisisID ,
57         Atype:etCrisisType ,
58         Astatus:etCrisisStatus ,
59         Alocation:dtGPSLocation ,
60         Ainstant:dtDateAndTime ,
61         Acomment:dtComment ):ptBoolean
62
63   operation handlingDelayPassed():ptBoolean
64   operation maxHandlingDelayPassed():ptBoolean
65   operation isSentToCoordinator(AactCoordinator:actCoordinator ):ptBoolean
66   operation isAllocatedIfPossible():ptBoolean
67  }
68
69  class ctHuman role rnctHuman cardinality [0..*]{
70   attribute id:dtPhoneNumber
71   attribute kind:etHumanKind
72
73   operation init(
74         Aid:dtPhoneNumber ,
75         Akind:etHumanKind ):ptBoolean
76   operation isAcknowledged():ptBoolean
77  }
78
79  class ctAuthenticated
80    role rnctAuthenticated
81    cardinality [0..*]{
82
```

```
83     attribute login:dtLogin
84     attribute pwd: dtPassword
85     attribute vpIsLogged:ptBoolean
86
87     operation init(
88           Alogin:dtLogin ,
89           Apwd:dtPassword ):ptBoolean
90    }
91
92    class ctCoordinator
93      role rnctCoordinator
94      cardinality [0..*]
95      extends ctAuthenticated{
96
97     attribute id:dtCoordinatorID
98
99     operation init(
100          Aid:dtCoordinatorID ,
101          Alogin:dtLogin ,
102          Apwd:dtPassword ):ptBoolean
103   }
104
105   class ctAdministrator
106     role rnctAdministrator
107     cardinality [1..1]
108     extends ctAuthenticated{
109
110    operation init(
111          Alogin:dtLogin ,
112          Apwd:dtPassword ):ptBoolean
113   }
114  }
115 }
116 }
```

Listing C.31: Messir Spec. file primarytypes-classes.msr.

C.32 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtAlertID.msr

```
1 package icrash.operations.concepts.primarytypes.datatypes.dtAlertID{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtAlertID.is():ptBoolean{
8
9   postF{
10  let TheResult: ptBoolean in
11  ( if
12   ( self.value.length().gt(0)
13    and self.value.length().leq(20)
14   )
15   then (TheResult = true)
16   else (TheResult = false)
17   endif
18   result = TheResult
19  )}
20  prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtAlertID-is.pl"}
21 }
22 }
23 }
```

Listing C.32: Messir Spec. file primarytypes-datatypes-dtAlertID.msr.

C.33 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtComment.msr

```
package icrash.operations.concepts.primarytypes.datatypes.dtComment{

import lu.uni.lassy.messir.libraries.primitives

Operation Model {

  operation: icrash.concepts.primarytypes.datatypes.dtComment.is():ptBoolean{

    postF{
    let TheResult: ptBoolean in
    ( if
     ( MaxLength = 160
      and self.value.length().leq(MaxLength)
     )
     then (TheResult = true)
     else (TheResult = false)
     endif
     result = TheResult
    )
  }
  prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtComment-is.pl"}
 }
}
}
```

Listing C.33: Messir Spec. file primarytypes-datatypes-dtComment.msr.

C.34 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtCoordinatorID.msr

```
package icrash.operations.concepts.primarytypes.datatypes.dtCoordinatorID{

import lu.uni.lassy.messir.libraries.primitives

Operation Model {
  operation: icrash.concepts.primarytypes.datatypes.dtCoordinatorID.is():ptBoolean{

  postF{
    let TheResult: ptBoolean in
    ( if
     ( self.value.length().gt(0)
      and self.value.length().leq(5)
     )
     then (TheResult = true)
     else (TheResult = false)
     endif
     result = TheResult
    )
  }
  prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtCoordinatorID-is.pl"
     }
 }
}
}
```

Listing C.34: Messir Spec. file primarytypes-datatypes-dtCoordinatorID.msr.

C.35 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtCrisisID.msr

```
package icrash.operations.concepts.primarytypes.datatypes.dtCrisisID{
```

```
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtCrisisID.is():ptBoolean{
8
9   postF{
10    let TheResult: ptBoolean in
11    ( if
12     ( self.value.length().gt(0)
13      and self.value.length().leq(10)
14     )
15     then (TheResult = true)
16     else (TheResult = false)
17     endif
18     result = TheResult
19    )
20  }
21  prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtCrisisID-is.pl"}
22 }
23 }
24 }
```

Listing C.35: Messir Spec. file primarytypes-datatypes-dtCrisisID.msr.

C.36 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtGPSLocation.msr

```
1 package icrash.operations.concepts.primarytypes.datatypes.dtGPSLocation{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5
6 import icrash.concepts.primarytypes.datatypes
7 import icrash.concepts.primarytypes.classes
8 import icrash.concepts.secondarytypes.datatypes
9 import icrash.concepts.secondarytypes.classes
10
11 Operation Model {
12
13   operation: icrash.concepts.primarytypes.datatypes.dtGPSLocation.is():ptBoolean{
14   postF{
15     let TheResult: ptBoolean in
16     ( if
17      ( self.latitude.is()
18       and self.longitude.is
19      )
20      then (TheResult = true)
21      else (TheResult = false)
22      endif
23      result = TheResult
24     )
25   }
26   prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtGPSLocation-is.pl"}
27   }
28   operation: icrash.concepts.primarytypes.datatypes.dtGPSLocation.isNearTo(aGPSLocation:
         dtGPSLocation):ptBoolean{
29   postF{
30     let TheResult: ptBoolean in true
31     let EarthRadius: dtReal in
32     let MaxDistance: dtReal in
33     let ComparedLatitude: dtLatitude in
34     let ComparedLongitude: dtLongitude in
35     let R1: dtReal in let R1a: dtReal in
36     let R2: dtReal in let R2a: dtReal in
37
38     ( if
```

```
39      ( EarthRadius.value = 6371
40       and MaxDistance.value = 100
41
42       and self.latitude = ComparedLatitude
43       and self.longitude = ComparedLongitude
44       and self.latitude.sin() = R1a
45       and self.latitude.sin().mul(R1a) = R1
46       and self.latitude.cos() = R2a
47       and self.latitude.cos().mul(R2a) = R2
48
49       and self.longitude = ComparedLongitude
50       and self.longitude.sub(ComparedLongitude).cos().mul(R2)
51           .add(R1).acos().mul(EarthRadius).sub(MaxDistance)
52           .value.leq(0)
53      )
54      then (TheResult = true)
55      else (TheResult = false)
56      endif
57      result = TheResult
58     )
59   }
60   prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtGPSLocation-isNearTo
         .pl"}
61   }
62   operation: icrash.concepts.primarytypes.datatypes.dtLatitude.is():ptBoolean{
63   postF{
64     let TheResult: ptBoolean in
65     ( if
66      ( AdtValue.value.geq(-90.0)
67       and AdtValue.value.leq(+90.0)
68      )
69      then (TheResult = true)
70      else (TheResult = false)
71      endif
72      result = TheResult
73     )}
74   prolog{ "src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtLatitude-is.pl"}
75   }
76   operation: icrash.concepts.primarytypes.datatypes.dtLongitude.is():ptBoolean{
77   postF{
78     let TheResult: ptBoolean in
79     ( if
80      ( AdtValue.value.geq(-180.0)
81       and AdtValue.value.leq(+180.0)
82      )
83      then (TheResult = true)
84      else (TheResult = false)
85      endif
86      result = TheResult
87     )}
88   prolog{ "src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtLongitude-is.pl"}
89  }
90 }
91 }
```

Listing C.36: Messir Spec. file primarytypes-datatypes-dtGPSLocation.msr.

C.37 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtLogin.msr

```
1 package icrash.operations.concepts.primarytypes.datatypes.dtLogin{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtLogin.is():ptBoolean{
8   postF{
```

```
9     let TheResult: ptBoolean in
10    let MaxLength: ptInteger in
11    ( if
12     ( MaxLength = 20
13      and self.value.length().leq(MaxLength)
14     )
15     then (TheResult = true)
16     else (TheResult = false)
17     endif
18     result = TheResult
19    )
20    }
21   prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtLogin-is.pl"}
22  }
23 }
24 }
```

Listing C.37: Messir Spec. file primarytypes-datatypes-dtLogin.msr.

C.38 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtPassword.msr

```
1 package icrash.operations.concepts.primarytypes.datatypes.dtPassword{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtPassword.is():ptBoolean{
8   postF{
9     let TheResult: ptBoolean in
10    let MinLength: ptInteger in
11    ( if
12     ( MinLength = 6
13      and self.value.length().geq(MinLength)
14     )
15     then (TheResult = true)
16     else (TheResult = false)
17     endif
18     result = TheResult
19    )
20 }
21   prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtPassword-is.pl"}
22  }
23 }
24 }
```

Listing C.38: Messir Spec. file primarytypes-datatypes-dtPassword.msr.

C.39 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtPhoneNumber.msr

```
1 package icrash.operations.concepts.primarytypes.datatypes.dtPhoneNumber{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtPhoneNumber.is():ptBoolean{
8
9   postF{
10  let TheResult: ptBoolean in
11  ( if
12   ( self.value.length().gt(4)
13    and self.value.length().leq(30)
14   )
```

```
15    then (TheResult = true)
16    else (TheResult = false)
17    endif
18    result = TheResult
19   )
20 }
21  prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtPhoneNumber-is.pl"}
22 }
23 }
24 }
```

Listing C.39: Messir Spec. file primarytypes-datatypes-dtPhoneNumber.msr.

C.40 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etAlertStatus.msr

```
1 package icrash.operations.concepts.primarytypes.datatypes.etAlertStatus{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.etAlertStatus.is():ptBoolean{
8   postF{
9     let TheResult: ptBoolean in
10    ( if
11     ( self = pending
12      or self = valid
13      or self = invalid
14     )
15     then (TheResult = true)
16     else (TheResult = false)
17     endif
18     result = TheResult
19    )
20  }
21 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etAlertStatus-is.pl"}
22 }
23 }
24 }
```

Listing C.40: Messir Spec. file primarytypes-datatypes-etAlertStatus.msr.

C.41 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etCrisisStatus.msr

```
1 package icrash.operations.concepts.primarytypes.datatypes.etCrisisStatus{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.etCrisisStatus.is():ptBoolean{
8   postF{
9     let TheResult: ptBoolean in
10    ( if
11     ( self = pending
12      or self = handled
13      or self = solved
14      or self = closed
15     )
16     then (TheResult = true)
17     else (TheResult = false)
18     endif
19     result = TheResult
20    )
```

```
21   }
22   prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etCrisisStatus-is.pl"}
23 }
24 }
25 }
```

Listing C.41: Messir Spec. file primarytypes-datatypes-etCrisisStatus.msr.

C.42 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etCrisisType.msr

```
1 package icrash.operations.concepts.primarytypes.datatypes.etCrisisType{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.etCrisisType.is():ptBoolean{
8   postF{
9     let TheResult: ptBoolean in
10    ( if
11     ( self = small
12      or self = medium
13      or self = huge
14     )
15     then (TheResult = true)
16     else (TheResult = false)
17     endif
18     result = TheResult
19    )
20    }
21 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etCrisisType-is.pl"}
22 }
23 }
24 }
```

Listing C.42: Messir Spec. file primarytypes-datatypes-etCrisisType.msr.

C.43 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etHumanKind.msr

```
1 package icrash.operations.concepts.primarytypes.datatypes.etHumanKind{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.etHumanKind.is():ptBoolean{
8   postF{
9     let TheResult: ptBoolean in
10    ( if
11     ( self = witness
12      or self = victim
13      or self = anonymous
14     )
15     then (TheResult = true)
16     else (TheResult = false)
17     endif
18     result = TheResult
19    )}
20 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etHumanKind-is.pl"}
21 }
22 }
23 }
```

Listing C.43: Messir Spec. file primarytypes-datatypes-etHumanKind.msr.

C.44 File ./src-gen/messir-spec/concepts/primarytypes-datatypes.msr

```
1 package icrash.concepts.primarytypes.datatypes {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.string
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.calendar
7
8  Concept Model {
9
10  Primary Types {
11
12   datatype dtAlertID extends dtString {
13    operation is():ptBoolean
14   }
15   datatype dtCrisisID extends dtString {
16    operation is():ptBoolean
17   }
18   datatype dtLogin extends dtString {
19    operation is():ptBoolean
20   }
21   datatype dtPassword extends dtString {
22    operation is():ptBoolean
23   }
24   datatype dtCoordinatorID extends dtString {
25    operation is():ptBoolean
26   }
27   datatype dtPhoneNumber extends dtString {
28    operation is():ptBoolean
29   }
30   datatype dtComment extends dtString {
31    operation is():ptBoolean
32   }
33   datatype dtLatitude extends dtReal {
34    operation is():ptBoolean
35   }
36   datatype dtLongitude extends dtReal {
37    operation is():ptBoolean
38   }
39   datatype dtGPSLocation {
40    attribute latitude: dtLatitude
41    attribute longitude: dtLongitude
42    operation is():ptBoolean
43    operation isNearTo(AGPSLocation:dtGPSLocation ):ptBoolean
44   }
45
46   enum etCrisisStatus {
47    constants["pending", "handled", "solved","closed"]
48    operation is():ptBoolean
49   }
50   enum etAlertStatus {
51    constants["pending", "valid", "invalid"]
52    operation is():ptBoolean
53   }
54   enum etCrisisType {
55    constants["small", "medium", "huge"]
56    operation is():ptBoolean
57   }
58   enum etHumanKind {
59    constants["witness", "victim", "anonymous"]
60    operation is():ptBoolean
61   }
62
63   //Michel
64   datatype dtCaptcha {//TODO: link to images
65    attribute id: ptInteger
66    attribute question: ptString
```

```
67    }
68    datatype dtCaptchaResponse {
69     attribute id: ptInteger
70     attribute response: ptString//TODO: Type?
71    }
72    datatype dtCaptchaImage extends dtString{
73     attribute width : ptInteger
74     attribute height : ptInteger
75    }
76
77    //Sam
78    datatype dtStatisticUserActivity{
79     attribute number: ptInteger
80     attribute time : dtTime
81    }
82    datatype dtStatisticCrisisinTime{
83     attribute number : ptInteger
84     attribute time : dtTime
85    }
86    datatype dtStatisticTypeCrisis{
87     attribute typeC : ptString
88     attribute time : dtTime
89    }
90
91   }
92  }
93 }
```

Listing C.44: Messir Spec. file primarytypes-datatypes.msr.

C.45 File ./src-gen/messir-spec/concepts/secondarytypes-associations.msr

```
1 package icrash.concepts.secondarytypes.associations {
2
3  Concept Model {
4
5   Secondary Types{
6
7   }
8  }
9 }
```

Listing C.45: Messir Spec. file secondarytypes-associations.msr.

C.46 File ./src-gen/messir-spec/concepts/secondarytypes-classes.msr

```
1 package icrash.concepts.secondarytypes.classes {
2
3  Concept Model {
4
5   Secondary Types{
6
7   }
8  }
9 }
```

Listing C.46: Messir Spec. file secondarytypes-classes.msr.

C.47 File ./src-gen/messir-spec/concepts/secondarytypes-datatypes.msr

```
package icrash.concepts.secondarytypes.datatypes {

import lu.uni.lassy.messir.libraries.primitives
import lu.uni.lassy.messir.libraries.string

import icrash.concepts.primarytypes.datatypes

 Concept Model {

  Secondary Types {

   datatype dtSMS {
    attribute value: ptString
    operation is():ptBoolean
   }
  }
 }
}
```

Listing C.47: Messir Spec. file secondarytypes-datatypes.msr.

C.48 File ./src-gen/messir-spec/usecases/subfunctions-usecases.msr

```
package icrash.usecases.subfunctions {

import lu.uni.lassy.messir.libraries.primitives

import icrash.concepts.primarytypes.datatypes
import icrash.concepts.primarytypes.classes
import icrash.concepts.secondarytypes.datatypes
import lu.uni.lassy.messir.libraries.primitives
import lu.uni.lassy.messir.libraries.math
import lu.uni.lassy.messir.libraries.calendar

import icrash.environment

 Use Case Model {

//-------------------------------------------------------
 use case system subfunction oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID, AdtLogin:dtLogin,
     AdtPassword:dtPassword){
  actor actAdministrator[primary,active]
  returned messages {
   ieCoordinatorAdded() returned to actAdministrator
  }
 }
//-------------------------------------------------------
 use case system subfunction oeAlert(
                  AetKind:etHumanKind,
                  AdtMyDate:dtDate,
                  AdtTime:dtTime,
                  AdtPhoneNumber:dtPhoneNumber,
                  AdtGPSLocation:dtGPSLocation,
                  AdtComment:dtComment) {
  actor actComCompany[primary,active]
  returned messages {
   ieSmsSend(AdtPhoneNumber,AdtSMS) returned to actComCompany
   }
 }
//-------------------------------------------------------
 use case system subfunction oeInvalidateAlert(AdtAlertID:dtAlertID) {
  actor actCoordinator[primary,active]
  actor actComCompany[secondary,passive]
  returned messages {
   ieMessage(AMessage) returned to actCoordinator
  }
 }
//-------------------------------------------------------
 use case system subfunction oeCloseCrisis(AdtCrisisID:dtCrisisID) {
```

```
 actor actCoordinator[primary,active]
 returned messages {
  ieMessage(AMessage) returned to actCoordinator
 }  }
//-----------------------------------------------------
use case system subfunction oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger) {
 actor actMsrCreator[primary,active]
}
//-----------------------------------------------------
use case system subfunction oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID) {
 actor actAdministrator[primary,active]
 returned messages {
  ieCoordinatorDeleted() returned to actAdministrator
 }
}
//-----------------------------------------------------
use case system subfunction oeGetAlertsSet(AetAlertStatus:etAlertStatus) {
 actor actCoordinator[primary,active]
 returned messages {
  ieSendAnAlert(ActAlert) returned to actCoordinator
 }
}
//-----------------------------------------------------
use case system subfunction oeGetCrisisSet(AetCrisisStatus:etCrisisStatus){
 actor actCoordinator[primary,active]
 returned messages {
  ieSendACrisis(ActCrisis) returned to actCoordinator
 }
}
//-----------------------------------------------------
use case system subfunction oeSetCrisisHandler(AdtCrisisID:dtCrisisID) {
 actor actCoordinator[primary,active]
 actor actCoordinator[secondary,passive]
 actor actComCompany[secondary,passive,multiple]
 returned messages {
  ieMessage(AMessage)
   returned to actCoordinator
  ieSendAnAlert(ActAlert)
   returned to actCoordinator
  ieSmsSend(AdtPhoneNumber,AdtSMS)
   returned to actComCompany
 }
}
//-----------------------------------------------------
use case system subfunction oeLogin(AdtLogin:dtLogin , AdtPassword:dtPassword) {//Modified by
   Michel
 actor actAuthenticated[primary,active]
 returned messages {
  ieConfirmCaptcha(ACaptcha) returned to actAuthenticated
  ieGenerateCaptcha returned to actCaptchaGenerator
  ieMessage(AMessage) returned to actAuthenticated
 }
}
//-----------------------------------------------------
use case system subfunction oeLogout() {
 actor actAuthenticated[primary,active]
 returned messages {
  ieMessage(AMessage) returned to actAuthenticated
 }
}
//-----------------------------------------------------
use case system subfunction oeReportOnCrisis(AdtCrisisID:dtCrisisID,AdtComment:dtComment) {
 actor actCoordinator[primary,active]
 returned messages {
  ieMessage(AMessage) returned to actCoordinator
 }
}
//-----------------------------------------------------
use case system subfunction oeSetClock(AcurrentClock:dtDateAndTime) {
 actor actActivator[primary,proactive]
```

```
115 }
116 //-------------------------------------------------------
117 use case system subfunction oeSetCrisisStatus(AdtCrisisID:dtCrisisID ,AetCrisisStatus:
       etCrisisStatus) {
118  actor actCoordinator[primary,active]
119  returned messages {
120   ieMessage(AMessage) returned to actCoordinator
121  }
122 }
123 //-------------------------------------------------------
124 use case system subfunction oeSollicitateCrisisHandling() {
125  actor actActivator[primary,proactive]
126  actor actCoordinator[secondary,passive,multiple]
127  actor actAdministrator[secondary,passive]
128  returned messages {
129   ieMessage(AMessage) returned to actCoordinator
130   //ieMessage(AMessage) returned to actAdministrator
131  }
132 }
133 //-------------------------------------------------------
134 use case system subfunction oeValidateAlert(AdtAlertID:dtAlertID) {
135  actor actCoordinator[primary,active]
136  returned messages {
137   ieMessage(AMessage) returned to actCoordinator
138  }
139 }
140
141 //Michel:
142 use case system subfunction oeSendCaptcha() {
143   actor actCaptchaGenerator[primary, active]
144   actor actAuthenticated[secondary]
145   returned messages{
146    ieConfirmCaptcha() returned to actAuthenticated
147   }
148 }
149 use case system subfunction oeSubmitCaptcha() {
150   actor actAuthenticated[primary, active]
151   actor actCaptchaValidator[secondary]
152   returned messages{
153    ieMessage returned to actAuthenticated
154    ieVerifyCaptcha returned to actCaptchaValidator
155   }
156 }
157
158 use case system subfunction oeCaptchaInvalid() {
159   actor actCaptchaValidator[primary, active]
160   actor actMailingService[secondary]
161   actor actAuthenticated[secondary]
162   returned messages{
163    ieSendMail() returned to actMailingService
164    ieMessage() returned to actAuthenticated
165   }
166  }
167 use case system subfunction oeCaptchaValid() {
168   actor actCaptchaValidator[primary, active]
169   actor actAuthenticated[secondary]
170   returned messages{
171    ieMessage() returned to actAuthenticated
172   }
173  }
174 //Vlad:
175 use case system subfunction oeCreateAlert(){
176  actor actAuthenticated[primary,active]
177  returned messages{
178   ieMessage(AMessage) returned to actAuthenticated
179  }
180 }
181 use case system subfunction oeUpdateCrisis(){
182  actor actCoordinator[primary, proactive]
183  returned messages{
```

```
184    ieMessage(AMessage) returned to actCoordinator
185   }
186  }
187  use case system subfunction oeSendNotification(){
188   actor actSystem[primary, active]
189  }
190
191  use case system subfunction oeChooseInformation(){
192   actor actSystem[primary, active]
193  }
194
195  //Sam:
196  use case system subfunction oeStatistic(){
197   actor actAdministrator[primary, active]
198   actor actSystem[secondary,passive]
199   returned messages{
200     ieCallTimeAndCrisisNumber returned to actSystem
201     ieCallUserActivity returned to actSystem
202     ieCallTypeWithTimeAverage returned to actSystem
203   }
204  }
205  use case system subfunction oeUserActivityStatistic(){
206   actor actAdministrator[primary, active]
207   actor actDatabase[secondary, passive]
208
209   returned messages{
210
211   }
212  }
213  use case system subfunction oeNumberOfCrisis(){
214   actor actAdministrator[primary, active]
215   actor actDatabase[secondary, passive]
216   returned messages{
217
218   }
219  }
220  use case system subfunction oeTimeOfTypeOfCrisis(){
221   actor actAdministrator[primary, active]
222   actor actDatabase[secondary, passive]
223   actor actSystem[secondary, passive]
224   returned messages{
225    ieCallTimeAndCrisisNumber returned to actSystem
226   }
227  }
228  use case system subfunction ugSercurelyUserSystem(){
229   actor actSystem[primary, active]
230
231  }
232  use case system subfunction oeSendStatistic(){
233   actor actSystem[primary, active]
234   actor actAdministrator[secondary, passive]
235   actor actDatabase[secondary, passive]
236   returned messages{
237     ieShowStaticTimeAverage returned to actAdministrator
238     ieShowStaticUser returned to actAdministrator
239     ieShowStaticCrisis returned to actAdministrator
240    }
241  }
242 }
243 }
```

Listing C.48: Messir Spec. file subfunctions-usecases.msr.

C.49 File ./src-gen/messir-spec/test/tc-testcase01.msr

```
1 package lu.uni.lassy.excalibur.examples.icrash.tests.testcase01 {
2
3 import lu.uni.lassy.messir.libraries.string
4 import lu.uni.lassy.messir.libraries.primitives
```

```
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.associations
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.primarytypes.datatypes
11 import icrash.concepts.secondarytypes.datatypes
12 import icrash.environment
13
14  Test Model{
15   test case testcase01 order 01 {
16 //-------------------------------------------------------------------------
17    test step ts01oeCreateSystemAndEnvironment order 01 {
18     variables{
19      Creator:actMsrCreator
20      AqtyComCompanies: ptInteger
21      }
22     constraints{
23       AqtyComCompanies = 4
24      }
25     test message{
26      out:Creator sends to system actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment(
       AqtyComCompanies)
27      }
28     oracle{
29      constraints{
30       true
31      }
32     }
33     prolog{"src/Tests/system/01/system-sim-01-01-oeCreateSystemAndEnvironment.pl"}
34    }
35 //-------------------------------------------------------------------------
36  test step ts02oeSetClock order 02{
37      variables{
38       TheActor:actActivator
39       ACurrentClock:dtDateAndTime
40       }
41      constraints{
42       TheActor=TheSystem.rnactActivator->any2(true)
43
44       ACurrentClock.date.year.value = 2017
45       ACurrentClock.date.month.value = 11
46       ACurrentClock.date.day.value = 24
47       ACurrentClock.time.hour.value = 15
48       ACurrentClock.time.minute.value = 20
49       ACurrentClock.time.second.value = 00
50      }
51  test message{
52      out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
53     }
54   oracle{
55     constraints{
56      true
57     }
58    }
59    }
60 //-------------------------------------------------------------------------
61
62 test step ts03oeLogin order 03{
63     variables{
64       TheActor : actAdministrator
65       AdtLogin:dtLogin
66       AdtPassword:dtPassword
67      }
68     constraints{
69       TheActor=TheSystem.rnactAdministrator->any2(true)
70       AdtLogin.value.eq('icrashadmin')
71       AdtPassword.value.eq('7WXC1359')
72      }
73     test message{
```

```
74      out:TheActor sends to system actAdministrator.outactAdministrator.oeLogin(AdtLogin,AdtPassword)
75     }
76    oracle{
77     variables{
78      AMessage:ptString
79     }
80     constraints{
81      AMessage = 'You are logged ! Welcome ...'
82      TheActor.inactAdministrator.ieMessage(AMessage)
83     }
84    }
85    }
86 //-------------------------------------------------------------------
87  test step ts04oeAddCoordinator order 04{
88     variables{
89       TheActor : actAdministrator
90       AdtCoordinatorID : dtCoordinatorID
91       AdtLogin:dtLogin
92       AdtPassword:dtPassword
93      }
94     constraints{
95       TheActor = TheSystem.rnactAdministrator->any2(true)
96       AdtCoordinatorID.value.eq('1')
97       AdtLogin.value.eq('steve')
98       AdtPassword.value.eq('pwdMessirExcalibur2017')
99      }
100    test message{
101     out:TheActor
102     sends to system actAdministrator.outactAdministrator.oeAddCoordinator
103                                 (AdtCoordinatorID,
104                                  AdtLogin,
105                                  AdtPassword)
106    }
107    oracle{
108     constraints{
109       TheActor.inactAdministrator.ieCoordinatorAdded()
110     }
111   }
112   }
113 //-------------------------------------------------------------------
114  test step ts05oeLogout order 05{
115     variables{
116       TheActor : actAdministrator
117      }
118     constraints{
119       TheActor = TheSystem.rnactAdministrator->any2(true)
120      }
121     test message{
122      out:TheActor sends to system actAdministrator.outactAdministrator.oeLogout()
123     }
124     oracle{
125      variables{
126       AMessage:ptString
127      }
128      constraints{
129      AMessage = 'You are logged out ! Good Bye ...'
130      TheActor.inactAdministrator.ieMessage(AMessage)
131     }
132    }
133   }
134 //-------------------------------------------------------------------
135  test step ts06oeSetClock02 order 06{
136     variables{
137       TheActor:actActivator
138       ACurrentClock:dtDateAndTime
139      }
140     constraints{
141       TheActor=TheSystem.rnactActivator->any2(true)
142       ACurrentClock.date.year.value = 2017
143       ACurrentClock.date.month.value = 11
```

```
144       ACurrentClock.date.day.value = 26
145       ACurrentClock.time.hour.value = 10
146       ACurrentClock.time.minute.value = 15
147       ACurrentClock.time.second.value = 00
148      }
149     test message{
150      out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
151     }
152     oracle{
153      constraints{
154      true
155     }
156    }
157    }
158 //-------------------------------------------------------------------------
159  test step ts07oeAlert1 order 07{
160     variables{
161       TheActor : actComCompany
162       AetHumanKind:etHumanKind
163       AdtDate:dtDate
164       AdtTime:dtTime
165       AdtPhoneNumber:dtPhoneNumber
166       AdtGPSLocation:dtGPSLocation
167       AdtComment:dtComment
168      }
169     constraints{
170       TheActor = TheSystem.rnactComCompany->any2(true)
171       AetHumanKind = witness
172       AdtDate.year.value = 2017
173       AdtDate.month.value = 11
174       AdtDate.day.value = 26
175       AdtTime.hour.value = 10
176       AdtTime.minute.value = 10
177       AdtTime.second.value = 16
178       AdtPhoneNumber.value = '+3524666445252'
179       AdtGPSLocation.latitude.value = 49.627675
180       AdtGPSLocation.longitude.value = 6.159590
181       AdtComment.value = '3 cars involved in an accident.'
182      }
183     test message{
184      out:TheActor
185      sends to system actComCompany.outactComCompany.oeAlert( AetHumanKind,
186                                  AdtDate,
187                                  AdtTime,
188                                  AdtPhoneNumber,
189                                  AdtGPSLocation,
190                                  AdtComment)
191     }
192     oracle{
193      variables{
194        AdtSMS:dtSMS
195      }
196      constraints{
197      AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
198      TheActor.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
199     }
200    }
201    }
202 //-------------------------------------------------------------------------
203  test step ts08oeSetClock03 order 08{
204     variables{
205       TheActor:actActivator
206       ACurrentClock:dtDateAndTime
207      }
208    constraints{
209       TheActor=TheSystem.rnactActivator->any2(true)
210       ACurrentClock.date.year.value = 2017
211       ACurrentClock.date.month.value = 11
212       ACurrentClock.date.day.value = 26
213       ACurrentClock.time.hour.value = 10
```

```
214       ACurrentClock.time.minute.value = 30
215       ACurrentClock.time.second.value = 00
216      }
217     test message{
218      out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
219     }
220     oracle{
221      constraints{
222       true
223      }
224    }
225    }
226 //-----------------------------------------------------------------------
227  test step ts09oeSollicitateCrisisHandling order 09{
228     variables{
229       TheActor : actActivator
230      }
231     constraints{
232       TheActor = TheSystem.rnactActivator->any2(true)
233      }
234     test message{
235      out:TheActor sends to system actActivator.outactActivator.oeSollicitateCrisisHandling()
236     }
237     oracle{
238     variables{
239       TheAdministrator:actAdministrator
240       TheCoordinator:actCoordinator
241       AMessageForCrisisHandlers:ptString
242      }
243      constraints{
244      TheAdministrator = TheSystem.rnactAdministrator->any2(true)
245      TheCoordinator = TheSystem.rnactCoordinator->any2(true)
246      AMessageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
         REACT !'
247
248      TheAdministrator.inactAdministrator.ieMessage(AMessageForCrisisHandlers)
249      TheCoordinator.inactAdministrator.ieMessage(AMessageForCrisisHandlers)
250
251 /* this oracle should be written like this (not currently possible due to grammar limitations:
252
253     oracle{
254     variables{
255       TheAdministrator:actAdministrator
256       AMessageForCrisisHandlers:ptString
257      }
258      constraints{
259      AMessageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
         REACT !'
260      TheAdministrator = TheSystem.rnactAdministrator->any2(true)
261
262      TheSystem.rnactCoordinator->forAll(TheCoordinator:actCoordinator | TheCoordinator.
        actAuthenticated.inactAuthenticated.ieMessage(AMessage))
263
264  */
265     }
266    }
267    }
268 //-----------------------------------------------------------------------
269  test step ts10oeLogin02 order 10{
270     variables{
271       TheActor : actCoordinator
272       AdtLogin:dtLogin
273       AdtPassword:dtPassword
274      }
275     constraints{
276       TheActor = TheSystem.rnactCoordinator->select(a | a.rnctCoordinator.login.value.eq('steve'))->
        any2(true)
277       AdtLogin.value.eq('steve')
278       AdtPassword.value.eq('pwdMessirExcalibur2017')
279      }
```

```
280     test message{
281      out:TheActor sends to system actAuthenticated.outactAuthenticated.oeLogin(AdtLogin,AdtPassword)
282     }
283     oracle{
284      variables{
285        AMessage:ptString
286      }
287      constraints{
288      AMessage = 'You are logged ! Welcome ...'
289      TheActor.inactAuthenticated.ieMessage(AMessage)
290     }
291    }
292    }
293 //-------------------------------------------------------------------------
294  test step ts11oeGetCrisisSet order 11{
295     variables{
296       TheActor : actCoordinator
297       AetCrisisStatus : etCrisisStatus
298      }
299     constraints{
300       TheActor=TheSystem.rnactCoordinator
301       ->select(a | a.rnctCoordinator.login.value.eq('steve'))
302       ->any2(true)
303       AetCrisisStatus = pending
304      }
305     test message{
306      out:TheActor sends to system actCoordinator.outactCoordinator.oeGetCrisisSet(AetCrisisStatus)
307     }
308     oracle{
309 //TODO - make consistent with test step implementation by adding Prolog code for input messages
310     variables{
311       ActCrisis:ctCrisis
312     }
313     constraints{
314      TheActor.inactCoordinator.ieSendACrisis(ActCrisis)
315     }
316    }
317    }
318 //-------------------------------------------------------------------------
319  test step ts12oeSetCrisisHandler order 12{
320     variables{
321       TheActor : actCoordinator
322       AdtCrisisID : dtCrisisID
323      }
324     constraints{
325       TheActor=TheSystem.rnactCoordinator
326       ->select(a | a.rnctCoordinator.login.value.eq('steve'))
327       ->any2(true)
328       //and AdtCrisisID.value= '1'
329      }
330     test message{
331      out:TheActor sends to system actCoordinator.outactCoordinator.oeSetCrisisHandler(AdtCrisisID)
332     }
333     oracle{
334      variables{
335       AMessage:ptString
336       AdtPhoneNumber:dtPhoneNumber
337       AdtSMS:dtSMS
338       ActAlert:ctAlert
339
340       TheComCompany: actComCompany
341       TheCoordinator:actCoordinator
342      }
343      constraints{
344       AMessage = 'You are now considered as handling the crisis !'
345       AdtSMS.value = 'The handling of your alert by our services is in progress !'
346       TheComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
347       TheCoordinator.inactCoordinator.ieSendAnAlert(ActAlert)
348       TheActor.inactAuthenticated.ieMessage(AMessage)
349     }
```

```
350    }
351    }
352 //-------------------------------------------------------------------
353  test step ts13oeSetClock04 order 13{
354     variables{
355       TheActor:actActivator
356       ACurrentClock:dtDateAndTime
357      }
358     constraints{
359       TheActor=TheSystem.rnactActivator->any2(true)
360       ACurrentClock.date.year.value = 2017
361       ACurrentClock.date.month.value = 11
362       ACurrentClock.date.day.value = 26
363       ACurrentClock.time.hour.value = 10
364       ACurrentClock.time.minute.value = 45
365       ACurrentClock.time.second.value = 00
366      }
367     test message{
368      out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
369     }
370     oracle{
371      constraints{
372      true
373     }
374    }
375    }
376 //-------------------------------------------------------------------
377  test step ts14oeValidateAlert order 14{
378     variables{
379       TheActor : actCoordinator
380       AdtAlertID : dtAlertID
381      }
382     constraints{
383       TheActor=TheSystem.rnactCoordinator
384       ->select(a | a.rnctCoordinator.login.value.eq('steve'))
385       ->any2(true)
386       //and AdtAlertID.value= '1'
387      }
388     test message{
389      out:TheActor sends to system actCoordinator.outactCoordinator.oeValidateAlert(AdtAlertID)
390     }
391     oracle{
392      variables{
393        AMessage:ptString
394      }
395      constraints{
396      AMessage = 'The Alert is now declared as valid !'
397      TheActor.actAuthenticated.inactAuthenticated.ieMessage(AMessage)
398     }
399    }
400    }
401 //-------------------------------------------------------------------
402  test step ts15oeAlert2 order 15{
403     variables{
404       TheActor : actComCompany
405       AetHumanKind:etHumanKind
406       AdtDate:dtDate
407       AdtTime:dtTime
408       AdtPhoneNumber:dtPhoneNumber
409       AdtGPSLocation:dtGPSLocation
410       AdtComment:dtComment
411      }
412     constraints{
413       TheActor = TheSystem.rnactComCompany->any2(true)
414       AetHumanKind = witness
415       AdtDate.year.value = 2017
416       AdtDate.month.value = 11
417       AdtDate.day.value = 26
418       AdtTime.hour.value = 10
419       AdtTime.minute.value = 20
```

```
420       AdtTime.second.value = 00
421       AdtPhoneNumber.value = '+3524666445000'
422       AdtGPSLocation.latitude.value = 49.627095
423       AdtGPSLocation.longitude.value = 6.160251
424       AdtComment.value = 'A car crash just happened.'
425      }
426     test message{
427      out:TheActor
428      sends to system actComCompany.outactComCompany.oeAlert( AetHumanKind,
429                                  AdtDate,
430                                  AdtTime,
431                                  AdtPhoneNumber,
432                                  AdtGPSLocation,
433                                  AdtComment)
434     }
435     oracle{
436      variables{
437       AdtSMS:dtSMS
438      }
439      constraints{
440      AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
441      TheActor.actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
442     }
443     }
444    }
445 //-------------------------------------------------------------------
446  test step ts16oeSetClock05 order 16{
447     variables{
448       TheActor:actActivator
449       ACurrentClock:dtDateAndTime
450      }
451     constraints{
452       TheActor=TheSystem.rnactActivator->any2(true)
453       ACurrentClock.date.year.value = 2017
454       ACurrentClock.date.month.value = 11
455       ACurrentClock.date.day.value = 26
456       ACurrentClock.time.hour.value = 12
457       ACurrentClock.time.minute.value = 45
458       ACurrentClock.time.second.value = 00
459      }
460     test message{
461      out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
462     }
463     oracle{
464      constraints{
465      true
466     }
467    }
468    }
469 //-------------------------------------------------------------------
470  test step ts17oeSetCrisisStatus order 17{
471     variables{
472       TheActor : actCoordinator
473       AdtCrisisID : dtCrisisID
474       AetCrisisStatus : etCrisisStatus
475      }
476     constraints{
477       TheActor=TheSystem.rnactCoordinator
478       ->select(a | a.rnctCoordinator.login.value.eq('steve'))
479       ->any2(true)
480       //and AdtCrisisID.value= '1'
481       //and AetCrisisStatus = solved
482      }
483     test message{
484      out:TheActor sends to system actCoordinator.outactCoordinator.oeSetCrisisStatus(AdtCrisisID,
      AetCrisisStatus)
485     }
486     oracle{
487      variables{
488       AMessage:ptString
```

```
489      }
490      constraints{
491      AMessage = 'The crisis status has been updated !'
492      TheActor.inactAuthenticated.ieMessage(AMessage)
493     }
494    }
495    }
496 //-------------------------------------------------------------------
497  test step ts18oeReportOnCrisis order 18{
498     variables{
499       TheActor : actCoordinator
500       AdtCrisisID : dtCrisisID
501       AdtComment : dtComment
502      }
503     constraints{
504       TheActor=TheSystem.rnactCoordinator
505       ->select(a | a.rnctCoordinator.login.value.eq('steve'))
506       ->any2(true)
507       //and AdtCrisisID.value= '1'
508       //and AdtComment.value = '3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
      mobilized'
509      }
510     test message{
511      out:TheActor sends to system actCoordinator.outactCoordinator.oeReportOnCrisis(AdtCrisisID,
      AdtComment)
512     }
513     oracle{
514      variables{
515       AMessage:ptString
516      }
517      constraints{
518      AMessage = 'The crisis comment has been updated !'
519      TheActor.inactAuthenticated.ieMessage(AMessage)
520     }
521    }
522    }
523 //-------------------------------------------------------------------
524  test step ts19oeCloseCrisis order 19{
525     variables{
526       TheActor : actCoordinator
527       AdtCrisisID : dtCrisisID
528      }
529     constraints{
530       TheActor=TheSystem.rnactCoordinator
531       ->select(a | a.rnctCoordinator.login.value.eq('steve'))
532       ->any2(true)
533       //and AdtCrisisID.value= '1'
534      }
535     test message{
536      out:TheActor sends to system actCoordinator.outactCoordinator.oeCloseCrisis(AdtCrisisID)
537     }
538     oracle{
539      variables {
540       AMessage:ptString
541      }
542      constraints{
543      AMessage = 'The crisis is now closed !'
544      TheActor.inactAuthenticated.ieMessage(AMessage)
545     }
546     }
547    }
548   }
549  }
550 }
```

Listing C.49: Messir Spec. file tc-testcase01.msr.

C.50 File ./src-gen/messir-spec/test/tci-testcase01-instance01.msr

```
package lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01 {

import lu.uni.lassy.messir.libraries.string
import lu.uni.lassy.messir.libraries.primitives
import lu.uni.lassy.messir.libraries.math
import lu.uni.lassy.messir.libraries.calendar

import icrash.concepts.primarytypes.associations
import icrash.concepts.primarytypes.classes
import icrash.concepts.primarytypes.datatypes
import lu.uni.lassy.excalibur.examples.icrash.tests.testcase01
import icrash.environment

Test Model {
 test case instance instance01:testcase01{
//-------------------------------------------------------
  test step instance tsi01:testcase01.ts01oeCreateSystemAndEnvironment{
   variables {
    theCreator:testcase01.ts01oeCreateSystemAndEnvironment.Creator = "theCreator"
    AqtyComCompanies : testcase01.ts01oeCreateSystemAndEnvironment.AqtyComCompanies="4"
    }
    oracle {
     satisfaction = "true"
    }
    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
   }
//-------------------------------------------------------
  test step instance tsi02: testcase01.ts02oeSetClock{
   variables {
    theClock:testcase01.ts02oeSetClock.TheActor = "theClock"
    ACurrentClock : testcase01.ts02oeSetClock.ACurrentClock= "2017:11:24 - 03:20:00"
    }
    oracle {
     satisfaction = "true"
    }
    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
   }
//-------------------------------------------------------
  test step instance tsi03: testcase01.ts03oeLogin{
   variables {
    bill:testcase01.ts03oeLogin.TheActor="bill"
    AdtLogin : testcase01.ts03oeLogin.AdtLogin= "icrashadmin"
    AdtPassword : testcase01.ts03oeLogin.AdtPassword= "7WXC1359"
    }
    oracle {
     satisfaction = "true"
     received message {
      AMessage : testcase01.ts03oeLogin.AMessage= 'You are logged ! Welcome ...'
      tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
     }
    }
    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
   }
//-------------------------------------------------------
  test step instance tsi04: testcase01.ts04oeAddCoordinator{
   variables {
    reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
    AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
    AdtLogin :testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
    AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
   }
   oracle {
     satisfaction = "true"
     received message {
     tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
     }
   }
    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
   }
//-------------------------------------------------------
```

```
71  test step instance tsi05: testcase01.ts05oeLogout{
72   variables {
73    reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
74   }
75   oracle {
76     satisfaction = "true"
77     received message {
78     AMessage : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
79     tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
80     }
81   }
82    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
83   }
84 //-----------------------------------------------------
85  test step instance tsi06: testcase01.ts06oeSetClock02{
86   variables {
87    reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
88    ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
89   }
90   oracle {
91     satisfaction = "true"
92   }
93    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
94   }
95 //-----------------------------------------------------
96  test step instance tsi07: testcase01.ts07oeAlert1{
97   variables {
98    tango:testcase01.ts07oeAlert1.TheActor ="tango"
99    AetHumanKind : testcase01.ts07oeAlert1.AetHumanKind = "witness"
100   AdtDate : testcase01.ts07oeAlert1.AdtDate = "2017:11:26"
101   AdtTime : testcase01.ts07oeAlert1.AdtTime = "10:10:16"
102   AdtPhoneNumber : testcase01.ts07oeAlert1.AdtPhoneNumber = "+3524666445252"
103   AdtGPSLocation : testcase01.ts07oeAlert1.AdtGPSLocation = "49.627675:6.159590"
104   AdtComment : testcase01.ts07oeAlert1.AdtComment = "3 cars involved in an accident."
105    }
106  oracle {
107    satisfaction = "true"
108    received message {
109    AdtSMS : testcase01.ts07oeAlert1.AdtSMS= 'Your alert has been registered. We will handle it and
       keep you informed'
110    tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
111
112     }
113  }
114   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
115  }
116
117 //-----------------------------------------------------
118  test step instance tsi08: testcase01.ts08oeSetClock03{
119   variables {
120    reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrentClock
121    ACurrentClock : testcase01.ts08oeSetClock03.ACurrentClock = "2017:11:26 - 10:30:00"
122   }
123   oracle {
124     satisfaction = "true"
125   }
126    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
127   }
128 //-----------------------------------------------------
129  test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
130   variables {
131    reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor
132    reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator
133   }
134   oracle {
135     satisfaction = "true"
136     received message {
137      steve:testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator ="steve"
138      AMessageForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
       AMessageForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please
```

```
      REACT !'
139
140      tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
         AMessageForCrisisHandlers)
141      tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
         AMessageForCrisisHandlers)
142           }
143    }
144     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
145    }
146
147 //-----------------------------------------------------
148   test step instance tsi10: testcase01.ts10oeLogin02{
149    variables {
150     reuse tsi09.steve as testcase01.ts10oeLogin02.TheActor
151     AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
152     AdtPassword : testcase01.ts10oeLogin02.AdtPassword= "pwdMessirExcalibur2017"
153    }
154    oracle {
155      satisfaction = "true"
156      received message {
157      AMessage : testcase01.ts10oeLogin02.AMessage= 'You are logged ! Welcome ...'
158      tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
159
160      }
161    }
162    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
163    }
164 //-----------------------------------------------------
165   test step instance tsi11: testcase01.ts11oeGetCrisisSet{
166    variables {
167     reuse tsi09.steve as testcase01.ts11oeGetCrisisSet.TheActor
168     AetCrisisStatus : testcase01.ts11oeGetCrisisSet.AetCrisisStatus = "pending"
169    }
170    oracle {
171      satisfaction = "true"
172      received message {
173      ActCrisis : testcase01.ts11oeGetCrisisSet.ActCrisis= "crisis with ID 1 details"
174      tsi09.steve received from system actCoordinator.inactCoordinator.ieSendACrisis(ActCrisis)
175      }
176    }
177    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
178    }
179 //-----------------------------------------------------
180   test step instance tsi12: testcase01.ts12oeSetCrisisHandler{
181    variables {
182     reuse tsi09.steve as testcase01.ts12oeSetCrisisHandler.TheActor
183     AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
184
185      reuse tsi07.tango as testcase01.ts12oeSetCrisisHandler.TheComCompany
186
187    }
188    oracle {
189      satisfaction = "true"
190      received message {
191      AMessage : testcase01.ts12oeSetCrisisHandler.AMessage= 'You are now considered as handling the
         crisis !'
192      AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
             is in progress !'
193      AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
194
195      tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
196      tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
197
198      }
199    }
200     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
201    }
202 //-----------------------------------------------------
203   test step instance tsi13: testcase01.ts13oeSetClock04{
```

```
204   variables {
205    reuse tsi02.theClock as testcase01.ts13oeSetClock04.TheActor
206     ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
207   }
208   oracle {
209     satisfaction = "true"
210   }
211   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
212   }
213 //-----------------------------------------------------
214  test step instance tsi14: testcase01.ts14oeValidateAlert{
215   variables {
216    reuse tsi09.steve as testcase01.ts14oeValidateAlert.TheActor
217    AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
218    }
219   oracle {
220     satisfaction = "true"
221     received message {
222     AMessage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
223     tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
224
225     }
226   }
227    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
228   }
229 //-----------------------------------------------------
230  test step instance tsi15: testcase01.ts15oeAlert2{
231   variables {
232    reuse tsi07.tango as testcase01.ts15oeAlert2.TheActor
233    AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind ="witness"
234    AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
235    AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
236    AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+3524666445000"
237    AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
238    AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
239   }
240   message {
241    tsi07.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert(
          AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
242
243   }
244   oracle {
245     satisfaction = "true"
246     received message {
247     AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
       keep you informed'
248     tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
249
250     }
251   }
252    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
253   }
254 //-----------------------------------------------------
255  test step instance tsi16: testcase01.ts16oeSetClock05{
256   variables {
257    reuse tsi02.theClock as testcase01.ts16oeSetClock05.TheActor
258    ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
259   }
260   oracle {
261     satisfaction = "true"
262     received message {
263
264     }
265   }
266    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
267   }
268 //-----------------------------------------------------
269  test step instance tsi17: testcase01.ts17oeSetCrisisStatus{
270   variables {
271    reuse tsi09.steve as testcase01.ts17oeSetCrisisStatus.TheActor
```

```
272     AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
273     AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
274    }
275    oracle {
276      satisfaction = "true"
277      received message {
278      AMessage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
279      tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
280      }
281    }
282     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
283    }
284 //-------------------------------------------------------
285   test step instance tsi18: testcase01.ts18oeReportOnCrisis{
286    variables {
287     reuse tsi09.steve as testcase01.ts18oeReportOnCrisis.TheActor
288     AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
289     AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
        evacuated and 4 rescue unit mobilized"
290    }
291    oracle {
292      satisfaction = "true"
293      received message {
294      AMessage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
295      tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
296
297      }
298    }
299     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
300    }
301 //-------------------------------------------------------
302   test step instance tsi19: testcase01.ts19oeCloseCrisis{
303    variables {
304     reuse tsi09.steve as testcase01.ts19oeCloseCrisis.TheActor
305     AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
306    }
307    oracle {
308      satisfaction = "true"
309      received message {
310      AMessage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
311
312     tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
313
314      }
315    }
316     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
317    }
318
319   }
320 //-------------------------------------------------------
321 //-------------------------------------------------------
322 //-------------------------------------------------------
323  test case instance instance01Part01:testcase01{
324 //-------------------------------------------------------
325   test step instance tsi01:testcase01.ts01oeCreateSystemAndEnvironment{
326    variables {
327     theCreator:testcase01.ts01oeCreateSystemAndEnvironment.Creator = "theCreator"
328     AqtyComCompanies : testcase01.ts01oeCreateSystemAndEnvironment.AqtyComCompanies="4"
329     }
330     oracle {
331      satisfaction = "true"
332     }
333     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
334    }
335 //-------------------------------------------------------
336   test step instance tsi02: testcase01.ts02oeSetClock{
337    variables {
338     theClock:testcase01.ts02oeSetClock.TheActor = "theClock"
339     ACurrentClock : testcase01.ts02oeSetClock.ACurrentClock= "2017:11:24 - 03:20:00"
340     }
```

```
341     oracle {
342      satisfaction = "true"
343     }
344     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
345    }
346 //-----------------------------------------------------
347   test step instance tsi03: testcase01.ts03oeLogin{
348    variables {
349     bill:testcase01.ts03oeLogin.TheActor="bill"
350     AdtLogin : testcase01.ts03oeLogin.AdtLogin= "icrashadmin"
351     AdtPassword : testcase01.ts03oeLogin.AdtPassword= "7WXC1359"
352     }
353     oracle {
354      satisfaction = "true"
355      received message {
356       AMessage : testcase01.ts03oeLogin.AMessage= 'You are logged ! Welcome ...'
357       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
358      }
359     }
360     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
361    }
362 //-----------------------------------------------------
363   test step instance tsi04: testcase01.ts04oeAddCoordinator{
364    variables {
365     reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
366     AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
367     AdtLogin :testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
368     AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
369    }
370    oracle {
371      satisfaction = "true"
372      received message {
373      tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
374      }
375    }
376     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
377    }
378 //-----------------------------------------------------
379   test step instance tsi05: testcase01.ts05oeLogout{
380    variables {
381     reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
382    }
383    oracle {
384      satisfaction = "true"
385      received message {
386      AMessage : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
387      tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
388      }
389    }
390     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
391    }
392 //-----------------------------------------------------
393   test step instance tsi06: testcase01.ts06oeSetClock02{
394    variables {
395     reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
396     ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
397    }
398    oracle {
399      satisfaction = "true"
400    }
401     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
402    }
403 //-----------------------------------------------------
404   test step instance tsi07: testcase01.ts07oeAlert1{
405    variables {
406     tango:testcase01.ts07oeAlert1.TheActor ="tango"
407     AetHumanKind : testcase01.ts07oeAlert1.AetHumanKind = "witness"
408     AdtDate : testcase01.ts07oeAlert1.AdtDate = "2017:11:26"
409     AdtTime : testcase01.ts07oeAlert1.AdtTime = "10:10:16"
410     AdtPhoneNumber : testcase01.ts07oeAlert1.AdtPhoneNumber = "+3524666445252"
```

```
411     AdtGPSLocation : testcase01.ts07oeAlert1.AdtGPSLocation = "49.627675:6.159590"
412     AdtComment : testcase01.ts07oeAlert1.AdtComment = "3 cars involved in an accident."
413     }
414    oracle {
415      satisfaction = "true"
416      received message {
417      AdtSMS : testcase01.ts07oeAlert1.AdtSMS= 'Your alert has been registered. We will handle it and
         keep you informed'
418      tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
419
420      }
421    }
422     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
423    }
424
425 //-------------------------------------------------------
426   test step instance tsi08: testcase01.ts08oeSetClock03{
427    variables {
428     reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrentClock
429     ACurrentClock : testcase01.ts08oeSetClock03.ACurrentClock = "2017:11:26 - 10:30:00"
430    }
431    oracle {
432      satisfaction = "true"
433    }
434     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
435    }
436 //-------------------------------------------------------
437   test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
438    variables {
439     reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor
440     reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator
441    }
442    oracle {
443      satisfaction = "true"
444      received message {
445       steve:testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator ="steve"
446       AMessageForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
         AMessageForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please
         REACT !'
447
448      tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
         AMessageForCrisisHandlers)
449      tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
         AMessageForCrisisHandlers)
450           }
451    }
452     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
453    }
454    }
455
456 //-------------------------------------------------------
457 //-------------------------------------------------------
458 //-------------------------------------------------------
459  test case instance instance01Part02:testcase01{
460
461   test step instance tsi10: testcase01.ts10oeLogin02{
462    variables {
463     steve : testcase01.ts10oeLogin02.TheActor
464     AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
465     AdtPassword : testcase01.ts10oeLogin02.AdtPassword= "pwdMessirExcalibur2017"
466    }
467    oracle {
468      satisfaction = "true"
469      received message {
470      AMessage : testcase01.ts10oeLogin02.AMessage= 'You are logged ! Welcome ...'
471      steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
472
473      }
474    }
475    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
```

```
476    }
477 //-----------------------------------------------------
478   test step instance tsi11: testcase01.ts11oeGetCrisisSet{
479    variables {
480     reuse tsi10.steve as testcase01.ts11oeGetCrisisSet.TheActor
481     AetCrisisStatus : testcase01.ts11oeGetCrisisSet.AetCrisisStatus = "pending"
482    }
483    oracle {
484      satisfaction = "true"
485      received message {
486      ActCrisis : testcase01.ts11oeGetCrisisSet.ActCrisis= "crisis with ID 1 details"
487      tsi10.steve received from system actCoordinator.inactCoordinator.ieSendACrisis(ActCrisis)
488      }
489    }
490    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
491    }
492 //-----------------------------------------------------
493   test step instance tsi12: testcase01.ts12oeSetCrisisHandler{
494    variables {
495     reuse tsi10.steve as testcase01.ts12oeSetCrisisHandler.TheActor
496     AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
497    }
498    oracle {
499      satisfaction = "true"
500      received message {
501      tango : testcase01.ts12oeSetCrisisHandler.TheComCompany
502      AMessage : testcase01.ts12oeSetCrisisHandler.AMessage= 'You are now considered as handling the
       crisis !'
503      AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
       is in progress !'
504      AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
505
506      tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
507      tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
508
509      }
510    }
511     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
512    }
513 //-----------------------------------------------------
514   test step instance tsi13: testcase01.ts13oeSetClock04{
515    variables {
516      theClock : testcase01.ts13oeSetClock04.TheActor
517      ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
518    }
519    oracle {
520      satisfaction = "true"
521    }
522    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
523    }
524 //-----------------------------------------------------
525   test step instance tsi14: testcase01.ts14oeValidateAlert{
526    variables {
527     reuse tsi10.steve as testcase01.ts14oeValidateAlert.TheActor
528     AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
529     }
530    oracle {
531      satisfaction = "true"
532      received message {
533      AMessage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
534      tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
535
536      }
537    }
538     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
539    }
540 //-----------------------------------------------------
541   test step instance tsi15: testcase01.ts15oeAlert2{
542    variables {
543     reuse tsi12.tango as testcase01.ts15oeAlert2.TheActor
```

```
544     AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind ="witness"
545     AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
546     AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
547     AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+3524666445000"
548     AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
549     AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
550    }
551    message {
552     tsi12.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert(
        AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
553
554    }
555    oracle {
556      satisfaction = "true"
557      received message {
558      AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
        keep you informed'
559      tsi12.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
560
561      }
562    }
563     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
564    }
565 //-----------------------------------------------------
566   test step instance tsi16: testcase01.ts16oeSetClock05{
567    variables {
568     reuse tsi13.theClock as testcase01.ts16oeSetClock05.TheActor
569     ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
570    }
571    oracle {
572      satisfaction = "true"
573      received message {
574
575      }
576    }
577     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
578    }
579 //-----------------------------------------------------
580   test step instance tsi17: testcase01.ts17oeSetCrisisStatus{
581    variables {
582     reuse tsi10.steve as testcase01.ts17oeSetCrisisStatus.TheActor
583     AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
584     AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
585    }
586    oracle {
587      satisfaction = "true"
588      received message {
589      AMessage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
590      tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
591      }
592    }
593     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
594    }
595 //-----------------------------------------------------
596   test step instance tsi18: testcase01.ts18oeReportOnCrisis{
597    variables {
598     reuse tsi10.steve as testcase01.ts18oeReportOnCrisis.TheActor
599     AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
600     AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
        evacuated and 4 rescue unit mobilized"
601    }
602    oracle {
603      satisfaction = "true"
604      received message {
605      AMessage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
606      tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
607
608      }
609    }
610     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
```

```
611    }
612 //-------------------------------------------------------
613   test step instance tsi19: testcase01.ts19oeCloseCrisis{
614    variables {
615     reuse tsi10.steve as testcase01.ts19oeCloseCrisis.TheActor
616     AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
617    }
618    oracle {
619      satisfaction = "true"
620      received message {
621      AMessage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
622
623     tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
624
625      }
626    }
627     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
628    }
629
630   }
631  }
632
633 }
```

Listing C.50: Messir Spec. file tci-testcase01-instance01.msr.

C.51 File ./src-gen/messir-spec/usecases/usecase-suDeployAndRun.msr

```
1 package icrash.usecases.suDeployAndRun {
2  import icrash.concepts.primarytypes.datatypes
3  import icrash.environment
4  import icrash.usecases.suGlobalCrisisHandling
5  import icrash.usecases.ugAdministrateTheSystem
6  import icrash.usecases.subfunctions
7
8  Use Case Model {
9   use case system summary suDeployAndRun() {
10    actor actAdministrator[primary,active]
11    actor actMsrCreator[secondary,active]
12    actor actCoordinator[secondary,active,multiple]
13    actor actActivator[secondary,proactive]
14    actor actComCompany[secondary,active]
15
16    reuse oeCreateSystemAndEnvironment[1..1]
17    reuse ugAdministrateTheSystem[1..*]
18    reuse suGlobalCrisisHandling[1..*]
19    reuse oeSetClock[1..*]
20    reuse oeSollicitateCrisisHandling[0..*]
21    reuse oeAlert[1..*]
22
23    step a: actMsrCreator executes oeCreateSystemAndEnvironment
24    step b: actAdministrator executes ugAdministrateTheSystem
25    step c: actComCompany executes oeAlert
26    step d: actActivator executes oeSetClock
27    step ^e: actActivator executes oeSollicitateCrisisHandling
28    step f: actCoordinator executes suGlobalCrisisHandling
29
30    ordering constraint
31     "step (a) must be always the first step."
32    ordering constraint
33     "step (f) can be executed by different actCoordinator actors."
34    ordering constraint
35     "if (e) then previously (d)."
36   }
37 //-------------------------------------------------------
38 //-------------------------------------------------------
39 //-------------------------------------------------------
```

```
40  use case instance uciSimpleAndComplete : suDeployAndRun {
41   actors {
42    theCreator : actMsrCreator
43    theClock : actActivator
44    bill : actAdministrator
45    tango : actComCompany
46    steve : actCoordinator
47   }
48   use case steps {
49 //-----------------------------------------------------
50    theCreator
51    executed instanceof subfunction
52       oeCreateSystemAndEnvironment("4"){}
53 //-----------------------------------------------------
54    theClock
55    executed instanceof subfunction
56       oeSetClock("2017:11:24 - 03:20:00"){}
57 //-----------------------------------------------------
58    bill
59    executed instanceof subfunction
60       oeLogin("icrashadmin","7WXC1359"){
61        ieMessage('You are logged ! Welcome ...') returned to bill
62       }
63 //-----------------------------------------------------
64    bill
65    executed instanceof subfunction
66       oeAddCoordinator("1","steve","pwdMessirExcalibur2017"){
67        ieCoordinatorAddedreturned returned to bill
68       }
69 //-----------------------------------------------------
70    bill
71    executed instanceof subfunction
72       oeLogout{
73        ieMessage('You are logged out ! Good Bye ...') returned to bill
74       }
75 //-----------------------------------------------------
76    theClock
77    executed instanceof subfunction
78       oeSetClock("2017:11:26 - 10:15:00"){}
79 //-----------------------------------------------------
80    tango
81    executed instanceof subfunction
82       oeAlert("witness","2017:11:26","10:10:16","+3524666445252",
83           "49.627675:6.159590","3 cars involved in an accident."){
84         ieSmsSend("+3524666445252","Your alert has been registered. We will handle it and keep you
     informed") returned to tango
85       }
86 //-----------------------------------------------------
87    theClock
88    executed instanceof subfunction
89       oeSetClock("2017:11:26 - 10:30:00"){}
90 //-----------------------------------------------------
91    theClock
92    executed instanceof subfunction
93       oeSollicitateCrisisHandling{
94        ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
95        returned to bill
96        ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
97        returned to steve
98       }
99 //-----------------------------------------------------
100   steve
101   executed instanceof subfunction
102      oeLogin("steve","pwdMessirExcalibur2017"){
103       ieMessage('You are logged ! Welcome ...') returned to steve
104      }
105 //-----------------------------------------------------
106   steve
107   executed instanceof subfunction
108      oeGetCrisisSet("pending"){
```

```
109         ieSendACrisis("crisis with ID 1 details") returned to steve
110        }
111 //-------------------------------------------------------
112     steve
113     executed instanceof subfunction
114        oeSetCrisisHandler("1"){
115         ieSmsSend("+3524666445252","The handling of your alert by our services is in progress !")
116         returned to tango
117         ieMessage("You are now considered as handling the crisis !")
118         returned to steve
119        }
120 //-------------------------------------------------------
121     theClock
122     executed instanceof subfunction
123        oeSetClock("2017:11:26 - 10:45:00"){}
124 //-------------------------------------------------------
125     steve
126     executed instanceof subfunction
127        oeValidateAlert("1"){
128         ieMessage('The Alert is now declared as valid !')
129         returned to steve
130        }
131 //-------------------------------------------------------
132     tango
133     executed instanceof subfunction
134        oeAlert("witness","2017:11:26","10:20:00","+3524666445000",
135            "49.627095:6.160251","A car crash just happened."){
136          ieSmsSend("+3524666445000","Your alert has been registered. We will handle it and keep you
       informed") returned to tango
137        }
138 //-------------------------------------------------------
139     theClock
140     executed instanceof subfunction
141        oeSetClock("2017:11:26 - 12:45:00"){}
142 //-------------------------------------------------------
143     steve
144     executed instanceof subfunction
145        oeSetCrisisStatus("1","solved"){
146         ieMessage('The crisis status has been updated !')
147         returned to steve
148        }
149 //-------------------------------------------------------
150     steve
151     executed instanceof subfunction
152        oeReportOnCrisis("1","3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
       mobilized"){
153         ieMessage('The crisis comment has been updated !')
154         returned to steve
155        }
156 //-------------------------------------------------------
157     steve
158     executed instanceof subfunction
159        oeCloseCrisis("1"){
160         ieMessage('The crisis is now closed !')
161         returned to steve
162        }
163
164    }
165   }
166 //-------------------------------------------------------
167 //-------------------------------------------------------
168 //-------------------------------------------------------
169   use case instance uciSimpleAndCompletePart01 : suDeployAndRun{
170
171    actors {
172     theCreator : actMsrCreator
173     theClock : actActivator
174     bill : actAdministrator
175     tango : actComCompany
176     steve : actCoordinator
```

```
177    }
178    use case steps {
179 //-------------------------------------------------------
180     theCreator
181     executed instanceof subfunction
182        oeCreateSystemAndEnvironment("4"){}
183 //-------------------------------------------------------
184     theClock
185     executed instanceof subfunction
186        oeSetClock("2017:11:24 - 03:20:00"){}
187 //-------------------------------------------------------
188     bill
189     executed instanceof subfunction
190        oeLogin("icrashadmin","7WXC1359"){
191         ieMessage('You are logged ! Welcome ...') returned to bill
192        }
193 //-------------------------------------------------------
194     bill
195     executed instanceof subfunction
196        oeAddCoordinator("1","steve","pwdMessirExcalibur2017"){
197         ieCoordinatorAddedreturned returned to bill
198        }
199 //-------------------------------------------------------
200     bill
201     executed instanceof subfunction
202        oeLogout{
203         ieMessage('You are logged out ! Good Bye ...') returned to bill
204        }
205 //-------------------------------------------------------
206     theClock
207     executed instanceof subfunction
208        oeSetClock("2017:11:26 - 10:15:00"){}
209 //-------------------------------------------------------
210     tango
211     executed instanceof subfunction
212        oeAlert("witness","2017:11:26","10:10:16","+3524666445252",
213            "49.627675:6.159590","3 cars involved in an accident."){
214          ieSmsSend("+3524666445252","Your alert has been registered. We will handle it and keep you
       informed") returned to tango
215        }
216 //-------------------------------------------------------
217     theClock
218     executed instanceof subfunction
219        oeSetClock("2017:11:26 - 10:30:00"){}
220 //-------------------------------------------------------
221     theClock
222     executed instanceof subfunction
223        oeSollicitateCrisisHandling{
224         ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
225         returned to bill
226         ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
227         returned to steve
228        }
229    }
230   }
231 //-------------------------------------------------------
232 //-------------------------------------------------------
233 //-------------------------------------------------------
234  use case instance uciSimpleAndCompletePart02 : suDeployAndRun{
235   actors {
236    theCreator : actMsrCreator
237    theClock : actActivator
238    bill : actAdministrator
239    tango : actComCompany
240    steve : actCoordinator
241   }
242   use case steps {
243
244 //-------------------------------------------------------
245    steve
```

```
246     executed instanceof subfunction
247        oeLogin("steve","pwdMessirExcalibur2017"){
248         ieMessage('You are logged ! Welcome ...') returned to steve
249        }
250 //-------------------------------------------------------
251     steve
252     executed instanceof subfunction
253        oeGetCrisisSet("pending"){
254         ieSendACrisis("crisis with ID 1 details") returned to steve
255        }
256 //-------------------------------------------------------
257     steve
258     executed instanceof subfunction
259        oeSetCrisisHandler("1"){
260         ieSmsSend("+3524666445252","The handling of your alert by our services is in progress !")
261         returned to tango
262         ieMessage("You are now considered as handling the crisis !")
263         returned to steve
264        }
265 //-------------------------------------------------------
266     theClock
267     executed instanceof subfunction
268        oeSetClock("2017:11:26 - 10:45:00"){}
269 //-------------------------------------------------------
270     steve
271     executed instanceof subfunction
272        oeValidateAlert("1"){
273         ieMessage('The Alert is now declared as valid !')
274         returned to steve
275        }
276 //-------------------------------------------------------
277     tango
278     executed instanceof subfunction
279        oeAlert("witness","2017:11:26","10:20:00","+3524666445000",
280            "49.627095:6.160251","A car crash just happened."){
281          ieSmsSend("+3524666445000","Your alert has been registered. We will handle it and keep you
       informed") returned to tango
282        }
283 //-------------------------------------------------------
284     theClock
285     executed instanceof subfunction
286        oeSetClock("2017:11:26 - 12:45:00"){}
287 //-------------------------------------------------------
288     steve
289     executed instanceof subfunction
290        oeSetCrisisStatus("1","solved"){
291         ieMessage('The crisis status has been updated !')
292         returned to steve
293        }
294 //-------------------------------------------------------
295     steve
296     executed instanceof subfunction
297        oeReportOnCrisis("1","3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
       mobilized"){
298         ieMessage('The crisis comment has been updated !')
299         returned to steve
300        }
301 //-------------------------------------------------------
302     steve
303     executed instanceof subfunction
304        oeCloseCrisis("1"){
305         ieMessage('The crisis is now closed !')
306         returned to steve
307        }
308
309    }
310   }
311  }
```

```
312 }
```

Listing C.51: Messir Spec. file usecase-suDeployAndRun.msr.

C.52 File ./src-gen/messir-spec/usecases/usecase-suGlobalCrisisHandling.msr

```
1 package icrash.usecases.suGlobalCrisisHandling {
2  import lu.uni.lassy.messir.libraries.primitives
3  import icrash.environment
4  import icrash.usecases.subfunctions
5  import icrash.usecases.ugSecurelyUseSystem
6  import icrash.usecases.ugManageCrisis
7  import icrash.usecases.ugMonitor
8
9  Use Case Model {
10  use case system summary
11   suGlobalCrisisHandling() {
12   actor actCoordinator[primary,active]
13
14   reuse ugSecurelyUseSystem[1..*]
15   reuse ugMonitor[1..*]
16   reuse ugManageCrisis[1..*]
17
18   step a: actCoordinator
19       executes ugSecurelyUseSystem
20   step b: actCoordinator
21       executes ugMonitor
22   step c: actCoordinator
23       executes ugManageCrisis
24
25   ordering constraint
26    "steps (a) (b) and (c) executions are interleaved
27    (steps (b) and (c) have their protocol constrained by steps of (a))."
28   ordering constraint
29     "steps (a) (b) and (c) can be executed multiple times."
30 }
31 }}
```

Listing C.52: Messir Spec. file usecase-suGlobalCrisisHandling.msr.

C.53 File ./src-gen/messir-spec/usecases/usecase-ugAdministrateTheSystem.msr

```
1 package icrash.usecases.ugAdministrateTheSystem {
2
3  import icrash.environment
4  import icrash.usecases.ugSecurelyUseSystem
5  import icrash.usecases.subfunctions
6
7  Use Case Model {
8
9   use case system usergoal
10   ugAdministrateTheSystem() {
11   actor actAdministrator[primary,active]
12
13   reuse ugSecurelyUseSystem[1..*]
14   reuse oeAddCoordinator[1..*]
15   reuse oeDeleteCoordinator[0..*]
16
17   step a: actAdministrator
18      executes ugSecurelyUseSystem
19   step b: actAdministrator
20      executes oeAddCoordinator
21   step c: actAdministrator
22      executes oeDeleteCoordinator
```

```
23
24    ordering constraint
25      "steps (a) (b) and (c) executions are interleaved
26      (steps (b) and (c) have their protocol constrained
27       by steps of (a))."
28    ordering constraint
29      "steps (a) (b) and (c) can be executed multiple times."
30   }
31  }
32 }
```

Listing C.53: Messir Spec. file usecase-ugAdministrateTheSystem.msr.

C.54 File ./src-gen/messir-spec/usecases/usecase-ugAverageTypeofCrisis.msr

```
1 /*
2 * @author michm
3 * @date Mon Mar 27 11:54:54 CEST 2017
4 */
5
6 package icrash.usecases.ugAverageTypeofCrisis {
7
8 import lu.uni.lassy.messir.libraries.primitives
9 import icrash.usecases.subfunctions
10 import icrash.environment
11
12 import icrash.usecases.ugAdministrateTheSystem
13
14  Use Case Model {
15   use case system usergoal ugAverageTypeofCrisis() {
16   actor actAdministrator[primary, active]
17   actor actDatabase [primary, proactive]
18   actor actSystem[secondary, active]
19
20   reuse oeStatistic[1..*]
21   reuse ugSercurelyUserSystem[0..*]
22   reuse oeTimeOfTypeOfCrisis[0..*]
23   reuse ugAdministrateTheSystem[1..*]
24
25   step a: actSystem
26   executes ugSercurelyUserSystem()
27
28   step b: actSystem
29   executes oeStatistic()
30
31   step c : actAdministrator
32   executes oeTimeOfTypeOfCrisis()
33
34   step d : actAdministrator
35   executes ugAdministrateTheSystem()
36
37   step e : actDatabase
38   executes oeTimeOfTypeOfCrisis()
39
40   ordering constraint "at least a"
41   ordering constraint "if b then previously a"
42   ordering constraint "if c then previously b"
43   ordering constraint "if d then previously c"
44
45   }
46  }
47
48 }
```

Listing C.54: Messir Spec. file usecase-ugAverageTypeofCrisis.msr.

C.55 File ./src-gen/messir-spec/usecases/usecase-ugCrisisInTime.msr

```
/*
* @author michm
* @date Mon Mar 27 11:53:28 CEST 2017
*/

package icrash.usecases.ugCrisisInTime {

import lu.uni.lassy.messir.libraries.primitives
import icrash.usecases.subfunctions
import icrash.environment

import icrash.usecases.ugAdministrateTheSystem

 Use Case Model {
  use case system usergoal ugCrisisInTime() {
  actor actAdministrator[primary, active]
  actor actDatabase [primary, proactive]
  actor actSystem[secondary, active]

  reuse oeStatistic[1..*]
  reuse ugSercurelyUserSystem[0..*]
  reuse oeNumberOfCrisis[0..*]
  reuse ugAdministrateTheSystem[1..*]

  step a: actSystem
  executes ugSercurelyUserSystem()

  step b: actSystem
  executes oeStatistic()

  step c : actAdministrator
  executes oeNumberOfCrisis()

  step d : actAdministrator
  executes ugAdministrateTheSystem()

  step e : actDatabase
  executes oeNumberOfCrisis()

  ordering constraint "at least a"
  ordering constraint "if b then previously a"
  ordering constraint "if c then previously b"
  ordering constraint "if d then previously c"
  }
 }

}
```

Listing C.55: Messir Spec. file usecase-ugCrisisInTime.msr.

C.56 File ./src-gen/messir-spec/usecases/usecase-ugLogin.msr

```
/*
* @author michm
* @date Mon Mar 27 11:29:20 CEST 2017
*/

package icrash.usecases.ugLogin {

import lu.uni.lassy.messir.libraries.primitives
import icrash.usecases.subfunctions
import icrash.environment

 Use Case Model {
  use case system usergoal ugLogin() {
```

```
14   actor actAuthenticated[primary, active]
15   actor actCaptchaGenerator[secondary, active]
16   actor actCaptchaValidator[secondary, active]
17   actor actMailingService[secondary, active]
18
19   reuse oeLogin[1..1]
20   reuse oeSendCaptcha[1..1]
21   reuse oeSubmitCaptcha[1..1]
22   reuse oeCaptchaInvalid[1..1]
23   reuse oeCaptchaValid[1..1]
24
25   step a: actAuthenticated
26   executes oeLogin
27
28   step b: actCaptchaGenerator
29   executes oeSendCaptcha
30
31   step c: actAuthenticated
32   executes oeSubmitCaptcha
33
34   step d: actCaptchaValidator
35   executes oeCaptchaInvalid
36
37   step e: actCaptchaValidator
38   executes oeCaptchaValid
39
40   ordering constraint "at least a"
41   ordering constraint "if b then previously a"
42   ordering constraint "if c then previously b"
43   ordering constraint "if d then previously c"
44   ordering constraint "if e then previously c"
45   }
46  }
47
48 }
```

Listing C.56: Messir Spec. file usecase-ugLogin.msr.

C.57 File ./src-gen/messir-spec/usecases/usecase-ugManageCrisis.msr

```
1 package icrash.usecases.ugManageCrisis {
2
3  import icrash.environment
4  import icrash.usecases.subfunctions
5
6  Use Case Model {
7
8   use case system usergoal ugManageCrisis() {
9    actor actCoordinator[primary, active]
10
11   reuse oeValidateAlert[0..*]
12   reuse oeSetCrisisStatus[0..*]
13   reuse oeSetCrisisHandler[0..*]
14   reuse oeReportOnCrisis[0..*]
15   reuse oeCloseCrisis[0..*]
16   reuse oeInvalidateAlert[0..*]
17
18   step a: actCoordinator executes oeValidateAlert
19   step b: actCoordinator executes oeSetCrisisStatus
20   step c: actCoordinator executes oeSetCrisisHandler
21   step d: actCoordinator executes oeReportOnCrisis
22   step f: actCoordinator executes oeCloseCrisis
23   step g: actCoordinator executes oeInvalidateAlert
24
25   ordering constraint "managing a crisis is doing one of the indicated use cases."
26
27   }
```

```
28
29  }
30 }
```

Listing C.57: Messir Spec. file usecase-ugManageCrisis.msr.

C.58 File ./src-gen/messir-spec/usecases/usecase-ugMonitor.msr

```
1 package icrash.usecases.ugMonitor {
2
3  import icrash.environment
4  import icrash.usecases.subfunctions
5
6  Use Case Model {
7   use case system usergoal ugMonitor() {
8    actor icrash.environment.actCoordinator[primary,active]
9
10   reuse oeGetCrisisSet[0..*]
11   reuse oeGetAlertsSet[0..*]
12
13   step a: icrash.environment.actCoordinator executes oeGetAlertsSet
14   step b: icrash.environment.actCoordinator executes oeGetCrisisSet
15  }
16 }
17 }
```

Listing C.58: Messir Spec. file usecase-ugMonitor.msr.

C.59 File ./src-gen/messir-spec/usecases/usecase-ugSecurelyUseSystem.msr

```
1 package icrash.usecases.ugSecurelyUseSystem {
2
3 import icrash.environment
4 import icrash.usecases.subfunctions
5
6 Use Case Model {
7
8 use case system usergoal
9  ugSecurelyUseSystem() {
10
11  actor actAuthenticated[primary,active]
12
13  reuse oeLogin[1..1]
14  reuse oeLogout[1..1]
15
16  step a: actAuthenticated
17     executes oeLogin
18  step b: actAuthenticated
19     executes oeLogout
20
21  ordering constraint
22   "step (a) must always precede step (b)."
23   }
24  }
25 }
```

Listing C.59: Messir Spec. file usecase-ugSecurelyUseSystem.msr.

C.60 File ./src-gen/messir-spec/usecases/usecase-ugUserActivity.msr

```
1 /*
2 * @author michm
3 * @date Mon Mar 27 11:31:30 CEST 2017
```

```
4 */
5
6 package icrash.usecases.ugUserActivity {
7
8 import lu.uni.lassy.messir.libraries.primitives
9 import icrash.usecases.subfunctions
10 import icrash.environment
11
12 import icrash.usecases.ugAdministrateTheSystem
13
14  Use Case Model {
15   use case system usergoal ugUserActivity() {
16   actor actAdministrator[primary, active]
17   actor actDatabase [primary, proactive]
18   actor actSystem[secondary, active]
19
20   reuse oeStatistic[1..*]
21   reuse ugSercurelyUserSystem[0..*]
22   reuse oeUserActivityStatistic[0..*]
23   reuse ugAdministrateTheSystem[1..*]
24
25   step a: actSystem
26   executes ugSercurelyUserSystem()
27
28   step b: actSystem
29   executes oeStatistic()
30
31   step c : actAdministrator
32   executes oeUserActivityStatistic()
33
34   step d : actAdministrator
35   executes ugAdministrateTheSystem()
36
37   step e : actDatabase
38   executes oeUserActivityStatistic()
39
40   ordering constraint "at least a"
41   ordering constraint "if b then previously a"
42   ordering constraint "if c then previously b"
43   ordering constraint "if d then previously c"
44
45   }
46
47  }
48
49 }
```

Listing C.60: Messir Spec. file usecase-ugUserActivity.msr.

C.61 File ./src-gen/messir-spec/usecases/usecase-ugVictimSendFamilyNotification.msr

```
1 /*
2 * @author michm
3 * @date Mon Mar 27 11:36:07 CEST 2017
4 */
5
6 package icrash.usecases.ugVictimSendFamilyNotification {
7
8 import lu.uni.lassy.messir.libraries.primitives
9 import icrash.usecases.subfunctions
10 import icrash.environment
11
12  Use Case Model {
13   use case system usergoal ugVictimSendFamilyNotification() {
14   actor actSystem[primary, active]
15   actor actAuthenticated[secondary, active]
16   actor actCoordinator[secondary, active]
```

```
17
18   reuse oeCreateAlert[1..*]
19   reuse oeValidateAlert[1..1]
20   reuse oeUpdateCrisis[0..*]
21
22   step a: actAuthenticated
23   executes oeCreateAlert()
24
25   step b: actCoordinator
26   executes oeCreateAlert()
27
28   step c: actCoordinator
29   executes oeValidateAlert(AdtAlertID)
30
31   step d: actSystem
32   executes oeChooseInformation()
33
34   step e: actCoordinator
35   executes oeUpdateCrisis()
36
37   ordering constraint "if c then previously a or b"
38   ordering constraint "if d then previously a or b"
39   ordering constraint "if e then previously a or b"
40   }
41  }
42
43 }
```

Listing C.61: Messir Spec. file usecase-ugVictimSendFamilyNotification.msr.

C.62 File ./src-gen/messir-spec/usecases/usecase-ugWitnessSendFamilyNotification.msr

```
1 /*
2 * @author michm
3 * @date Mon Mar 27 11:35:08 CEST 2017
4 */
5
6 package icrash.usecases.ugWitnessSendFamilyNotification {
7
8 import lu.uni.lassy.messir.libraries.primitives
9 import icrash.usecases.subfunctions
10 import icrash.environment
11
12  Use Case Model {
13   use case system usergoal ugWitnessSendFamilyNotification() {
14   actor actSystem[primary, active]
15   actor actAuthenticated[secondary, active]
16   actor actCoordinator[secondary, proactive]
17
18   reuse oeCreateAlert[1..*]
19   reuse oeValidateAlert[1..1]
20   reuse oeUpdateCrisis[0..*]
21
22   step a: actAuthenticated
23   executes oeCreateAlert()
24
25   step b: actCoordinator
26   executes oeCreateAlert()
27
28   step c: actCoordinator
29   executes oeValidateAlert()
30
31   step d: actSystem
32   executes oeChooseInformation()
33
34   step e: actCoordinator
35   executes oeUpdateCrisis()
```

```
36
37   ordering constraint "if c then previously a or b"
38   ordering constraint "if d then previously a or b"
39   ordering constraint "if e then previously a or b"
40   }
41  }
42
43 }
```

Listing C.62: Messir Spec. file usecase-ugWitnessSendFamilyNotification.msr.

C.63 File ./src-gen/messir-spec/usecases/usecaseinstance-uciugLogin.msr

```
1 /*
2 * @author michm
3 * @date Mon Mar 27 13:56:35 CEST 2017
4 */
5
6 package usecases.uciugLogin {
7
8 import lu.uni.lassy.messir.libraries.primitives
9 import icrash.environment
10 import icrash.usecases.subfunctions
11 import icrash.usecases.ugLogin
12
13  Use Case Model {
14   use case instance uciugLoginSuccess : ugLogin{
15    actors {
16     MKremer : actAuthenticated
17    }
18    use case steps {
19     MKremer executed instanceof subfunction oeLogin("mkremer003", "Raichu124"){
20      ieMessage("You are now logged in!") returned to MKremer
21     }
22
23    }
24   }
25   use case instance uciugLoginFailure : ugLogin{
26    actors {
27     MKremer : actAuthenticated
28    }
29    use case steps {
30     MKremer executed instanceof subfunction oeLogin("mkremer003", "Raichu124"){
31      ieMessage("Wrong user name or password. Try again.") returned to MKremer
32     }
33
34    }
35   }
36   use case instance uciugLoginCaptchaSuccess : ugLogin{
37    actors {
38     MKremer : actAuthenticated
39     CaptchaGenerator : actCaptchaGenerator
40     CaptchaValidator : actCaptchaValidator
41    }
42    use case steps {
43     MKremer executed instanceof subfunction oeLogin("mkremer003", "Raichu124") {
44      ieGenerateCaptcha() returned to CaptchaGenerator
45     }
46     CaptchaGenerator executed instanceof subfunction oeSendCaptcha("Captcha test") {
47      ieConfirmCaptcha("Captcha test") returned to MKremer
48     }
49     MKremer executed instanceof subfunction oeSubmitCaptcha("Captcha user response") {
50      ieVerifyCaptcha("Captcha user response") returned to CaptchaValidator
51     }
52     CaptchaValidator executed instanceof subfunction oeCaptchaValid("Captcha id"){
53      ieMessage("You are now logged in!") returned to MKremer
54     }
```

```
55    }
56   }
57   use case instance uciugLoginCaptchaFailure : ugLogin{
58    actors {
59     MKremer : actAuthenticated
60     CaptchaGenerator : actCaptchaGenerator
61     CaptchaValidator : actCaptchaValidator
62    }
63    use case steps {
64     MKremer executed instanceof subfunction oeLogin("mkremer003", "Raichu124") {
65      ieGenerateCaptcha() returned to CaptchaGenerator
66     }
67     CaptchaGenerator executed instanceof subfunction oeSendCaptcha("Captcha test") {
68      ieConfirmCaptcha("Captcha test") returned to MKremer
69     }
70     MKremer executed instanceof subfunction oeSubmitCaptcha("Captcha user response") {
71      ieVerifyCaptcha("Captcha user response") returned to CaptchaValidator
72     }
73     CaptchaValidator executed instanceof subfunction oeCaptchaInvalid("Captcha id"){
74      ieMessage("Your submitted captcha response is invalid. Try again.") returned to MKremer
75     }
76
77    }
78   }
79   use case instance uciugLoginCaptchaToleranceExceeded : ugLogin{
80    actors {
81     MKremer : actAuthenticated
82     CaptchaGenerator : actCaptchaGenerator
83     CaptchaValidator : actCaptchaValidator
84     GMail : actMailingService
85    }
86    use case steps {
87     MKremer executed instanceof subfunction oeLogin("mkremer003", "Raichu124") {
88      ieGenerateCaptcha() returned to CaptchaGenerator
89     }
90     CaptchaGenerator executed instanceof subfunction oeSendCaptcha("Captcha test") {
91      ieConfirmCaptcha("Captcha test") returned to MKremer
92     }
93     MKremer executed instanceof subfunction oeSubmitCaptcha("Captcha user response") {
94      ieVerifyCaptcha("Captcha user response") returned to CaptchaValidator
95     }
96     CaptchaValidator executed instanceof subfunction oeCaptchaInvalid("Captcha id"){
97      ieSendMail("michel.kremer.003@student.uni.lu", "Your account has been locked", "Notification
            and unblocking instructions (a bit too long to write here...)") returned to GMail
98      ieMessage("Your user name will be blocked for logging in. Please contact an administrator.")
            returned to MKremer
99     }
100
101   }
102  }
103  use case instance uciugLoginRejected : ugLogin{
104   actors {
105    MKremer : actAuthenticated
106   }
107   use case steps {
108    MKremer executed instanceof subfunction oeLogin("mkremer003", "Raichu124"){
109     ieMessage("The requested user is blocked from logging in") returned to MKremer
110    }
111
112   }
113  }
114 }
115
116 }
```

Listing C.63: Messir Spec. file usecaseinstance-uciugLogin.msr.

C.64 File ./src-gen/messir-spec/usecases/usecaseinstance-ugAverageTypeofCrisis-uciugStatisticAvergeTypeofCrisis.msr

```
1 package usecases.uciugAverageTypeofCrisis {
2  import icrash.usecases.ugAverageTypeofCrisis
3  import icrash.environment
4  import icrash.usecases.subfunctions
5
6  Use Case Model {
7
8   use case instance uciugStatisticAverageTypeofCrisis : ugAverageTypeofCrisis{
9    actors {
10    User : actAdministrator
11    Database : actDatabase
12   }
13   use case steps {
14    User executed instanceof subfunction oeStatistic{
15     ieCallTypeWithTimeAverage() returned to Database
16    }
17    Database executed instanceof subfunction oeSendStatistic("For the average time for the different
          type of crises"){
18     ieShowStatisticTimeAverage() returned to User
19    }
20
21   }
22  }
23 }
24 }
```

Listing C.64: Messir Spec. file usecaseinstance-ugAverageTypeofCrisis-uciugStatisticAvergeTypeofCrisis.msr.

C.65 File ./src-gen/messir-spec/usecases/usecaseinstance-ugCrisisInTime-uciugStatisticCrisisInTime.msr

```
1 package usecases.uciugCrisisInTime {
2  import icrash.usecases.ugCrisisInTime
3  import icrash.environment
4  import icrash.usecases.subfunctions
5
6  Use Case Model {
7
8   use case instance uciugStatisticCrisisInTime : ugCrisisInTime{
9    actors {
10    User : actAdministrator
11    Database : actDatabase
12   }
13   use case steps {
14    User executed instanceof subfunction oeStatistic{
15     ieCallTimeAndCrisisNumber() returned to Database
16    }
17    Database executed instanceof subfunction oeSendStatistic("For the number of cisises in time for
          the different type of crisis"){
18     ieShowStatisticCrisis() returned to User
19    }
20
21   }
22  }
23 }
24 }
```

Listing C.65: Messir Spec. file usecaseinstance-ugCrisisInTime-uciugStatisticCrisisInTime.msr.

C.66 File ./src-gen/messir-spec/usecases/usecaseinstance-ugSecurelyUseSystem-uciugSecurelyUseSystem.msr

```
package usecases.uciugSecurelyUseSystem {
 import icrash.usecases.ugSecurelyUseSystem
  import icrash.usecases.ugSecurelyUseSystem
  import icrash.concepts.primarytypes.datatypes
  import icrash.environment
  import icrash.usecases.suGlobalCrisisHandling
  import icrash.usecases.ugAdministrateTheSystem
  import icrash.usecases.subfunctions

 Use Case Model {

//------------------------------
  use case instance uciugSecurelyUseSystem : ugSecurelyUseSystem {
   actors {
    bill:actAuthenticated
   }
   use case steps {
//------------------------------
    bill
    executed instanceof subfunction
       oeLogin("icrashadmin","7WXC1359"){
        ieMessage('You are logged ! Welcome ...') returned to bill
       }
//------------------------------
    bill
    executed instanceof subfunction
       oeLogout{
        ieMessage('You are logged out ! Good Bye ...') returned to bill
       }
   }
  }
 }
}
```

Listing C.66: Messir Spec. file usecaseinstance-ugSecurelyUseSystem-uciugSecurelyUseSystem.msr.

C.67 File ./src-gen/messir-spec/usecases/usecaseinstance-ugUserActivity-uciugUserActivity.msr

```
package usecases.uciugUserActivity {
 import icrash.usecases.ugUserActivity
 import icrash.environment
 import icrash.usecases.subfunctions

 Use Case Model {

  use case instance uciugUserActivity : ugUserActivity{
   actors {
    User : actAdministrator
    Database : actDatabase

   }
   use case steps {
    User executed instanceof subfunction oeStatistic{
     ieCallUserActivity() returned to Database
    }
    Database executed instanceof subfunction oeSendStatistic("Statistic for the user activity"){
     ieShowStatisticUser() returned to User
    }
   }
  }
 }
```

```
24 }
```

Listing C.67: Messir Spec. file usecaseinstance-ugUserActivity-uciugUserActivity.msr.

C.68 File ./src-gen/messir-spec/usecases/usecaseinstance-ugVictimSendFamilyNotification-uciugVictimSendFamilyNotification.msr

```
1 package usecases.uciugVictimSendFamilyNotification {
2  import icrash.usecases.ugVictimSendFamilyNotification
3  import icrash.environment
4  import icrash.usecases.subfunctions
5
6  Use Case Model {
7
8   use case instance uciugVictimSendFamilyNotification : ugVictimSendFamilyNotification{
9    actors {
10    User : actAuthenticated
11    Coordinator : actCoordinator
12    System : actSystem
13   }
14   use case steps {
15    User executed instanceof subfunction oeCreateAlert("Chose if an alert will be sent to the family
          "){
16
17    }
18    Coordinator executed instanceof subfunction oeCreateAlert(){
19
20    }
21    Coordinator executed instanceof subfunction oeValidateAlert(){
22
23    }
24    Coordinator executed instanceof subfunction oeUpdateCrisis(){
25
26    }
27    System executed instanceof subfunction oeSendNotification(){
28
29    }
30   }
31  }
32 }
33 }
```

Listing C.68: Messir Spec. file usecaseinstance-ugVictimSendFamilyNotification-uciugVictimSendFamilyNotification.msr.

C.69 File ./src-gen/messir-spec/usecases/usecaseinstance-ugWitnessSendFamilyNotification-uciugWitnessSendFamilyNotification.ms

```
1 package usecases.uciugWitnessSendFamilyNotification {
2  import icrash.usecases.ugWitnessSendFamilyNotification
3  import icrash.environment
4  import icrash.usecases.subfunctions
5
6  Use Case Model {
7
8   use case instance uciugWitnessSendFamilyNotification : ugWitnessSendFamilyNotification{
9    actors {
10    User : actAuthenticated
11    Coordinator : actCoordinator
12    System : actSystem
13
14   }
15   use case steps {
16    User executed instanceof subfunction oeCreateAlert("Add name and surname of the victim"){
17
18    }
```

```
19     Coordinator executed instanceof subfunction oeCreateAlert(){
20
21     }
22     Coordinator executed instanceof subfunction oeValidateAlert(){
23
24     }
25     Coordinator executed instanceof subfunction oeUpdateCrisis(){
26
27     }
28     System executed instanceof subfunction oeSendNotification(){
29
30     }
31    }
32   }
33  }
34 }
```

Listing C.69: Messir Spec. file usecaseinstance-ugWitnessSendFamilyNotification-uciugWitnessSendFamilyNotification.msr.

Appendix D

Listing of the Prolog Files Referenced in the Operation Model Specification

D.1 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactActiva oeSetClock.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%-----------------------------------------------------
msrop(outactActivator,
   oeSetClock,
   [preProtocol,Self,
    AcurrentClock
    ],
   []):-
/* Pre Protocol:*/
/* PreP01 */
 msrVar(ctState,TheSystem),
 msrVar(ptBoolean,AvpStarted),

 msrNav([Self],[rnActor,rnSystem],[TheSystem]),

 msrNav([Self],[rnActor,rnSystem,vpStarted],[AvpStarted]),
 AvpStarted = [ptBoolean,true],

 msrNav([TheSystem],
    [clock,lt,[AcurrentClock]],
    [[ptBoolean,true]])
 .

msrop(outactActivator,
   oeSetClock,
   [preFunctional,Self,
    AcurrentClock
    ],
   []):-
/* Pre Functional:*/
/* PreF01 */
true.

msrop(outactActivator,
   oeSetClock,
   [post,Self,
    AcurrentClock
    ],
    []):-

```

```
44 msrVar(ctState,TheSystem),
45
46/* Post Functional:*/
47
48 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
49
50/* PostF01 */
51 msrNav([TheSystem],
52     [msmAtPost,clock],
53     [AcurrentClock]),
54
55 /* Post Protocol:*/
56/* PostP01 */
57 true
58 .
```

Listing D.1: Prolog file outactActivator-oeSetClock.pl.

D.2 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAc oeSollicitateCrisisHandling.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----------------------------------------------------
6
7msrop(outactActivator,
8   oeSollicitateCrisisHandling,
9   [preProtocol,Self
10    ],
11   []):-
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
15
16 msrVarCol(ctCrisis,_,ColctCrisisToHandle),
17
18/* PreP01 */
19 msrNav([TheSystem],
20    [vpStarted],
21    [[ptBoolean,true]]),
22
23/* PreP02 */
24 msrNav([TheSystem],
25    [rnctCrisis,msrSelect,
26     handlingDelayPassed,[]
27    ],
28    ColctCrisisToHandle),
29
30 msrNav(ColctCrisisToHandle,
31    [msrSize,geq,[[ptInteger,1]]],
32    [[ptBoolean,true]])
33.
34
35msrop(outactActivator,
36   oeSollicitateCrisisHandling,
37   [preFunctional,Self
38    ],
39   []):-
40/* Pre Functional:*/
41/* PreF01 */
42true.
43
44msrop(outactActivator,
45   oeSollicitateCrisisHandling,
46   [post,Self
47    ],
```

```
48     []):-
49
50  msrVar(ctState,TheSystem),
51  msrVar(dtComment,AMessageForCrisisHandlers),
52  msrVar(dtDateAndTime, TheClock),
53  msrVarCol(ctCrisis,_,ColctCrisisToAllocateIfPossible),
54
55 /* Post Functional:*/
56  msrNav([Self],[rnActor,rnSystem],[TheSystem]),
57
58  /* PostF01 */
59  msrNav([TheSystem],
60     [rnctCrisis,msrSelect,
61      maxHandlingDelayPassed,[]
62     ],
63     ColctCrisisToAllocateIfPossible),
64
65 msrNav(ColctCrisisToAllocateIfPossible,
66     [msrForAll,isAllocatedIfPossible,[]],
67     [[ptBoolean,true]]),
68
69  /* PostF02 */
70  msrNav([TheSystem],
71     [rnctCrisis,msrSelect,
72      handlingDelayPassed,[]
73     ],
74     ColctCrisisToHandle),
75
76  msrNav(ColctCrisisToHandle,
77      [msrColSubtract,[ColctCrisisToAllocateIfPossible]
78      ],
79      ColctCrisisToRemind),
80
81  (msrNav(ColctCrisisToRemind,
82      [msrSize,geq,[[ptInteger,1]]],
83      [[ptBoolean,true]])
84   -> (msrNav([AMessageForCrisisHandlers],
85       [value],
86       [[ptString,'There are alerts pending since more than the defined delay. Please REACT !']]),
87
88     msrNav([TheSystem],
89        [rnactAdministrator,rnInterfaceIN,
90         ieMessage,[AMessageForCrisisHandlers]
91        ],
92        [[ptBoolean,true]]),
93
94     msrNav([TheSystem],
95        [rnactCoordinator,msrForAll,rnInterfaceIN,
96         ieMessage,[AMessageForCrisisHandlers]
97        ],
98        [[ptBoolean,true]])
99    )
100 ; true
101 ),
102
103 /* Post Protocol:*/
104 /* PostP01 */
105 msrNav([TheSystem],
106    [clock],
107    [TheClock]),
108
109 msrNav([TheSystem],
110     [msmAtPost,vpLastReminder],
111     [TheClock])
112 .
```

Listing D.2: Prolog file outactActivator-oeSollicitateCrisisHandling.pl.

D.3 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAdoeAddCoordinator.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%-----------------------------------------------------------
msrop(outactAdministrator,
   oeAddCoordinator,
   [preProtocol,Self,
    AdtCoordinatorID,
    AdtLogin,
    AdtPassword
    ],
   []):-
/* Pre Protocol:*/
 msrVar(ctState,TheSystem),
 msrVar(actAdministrator,TheActor),
 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
 msrNav([Self],[rnActor],[TheActor]),

/* PreP01 */
 msrNav([TheSystem],
    [vpStarted],
    [[ptBoolean,true]]),

/* PreP02 */
 msrNav([TheActor],
    [rnctAuthenticated,vpIsLogged],
    [[ptBoolean,true]])

 .

msrop(outactAdministrator,
   oeAddCoordinator,
   [preFunctional,Self,
    AdtCoordinatorID,
    AdtLogin,
    AdtPassword
    ],
   []):-
/* Pre Functional:*/
 msrVar(ctState,TheSystem),
 msrVar(actAdministrator,TheActor),
 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
 msrNav([Self],[rnActor],[TheActor]),
/* PreF01 */
 msrNav([TheSystem],
     [rnctCoordinator,
     msrSelect,id,eq,[AdtCoordinatorID]],
     ColctCoordinators),
 msrNav(ColctCoordinators,
     [msrIsEmpty],
     [[ptBoolean,true]])
 .

msrop(outactAdministrator,
   oeAddCoordinator,
   [post,Self,
    AdtCoordinatorID,
    AdtLogin,
    AdtPassword
    ],
    []):-

/* Post Functional:*/
 msrVar(ctState,TheSystem),
 msrVar(actAdministrator,TheActor),
```

```
67 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
68 msrNav([Self],[rnActor],[TheActor]),
69
70 msrVar(actCoordinator,TheactCoordinator),
71 msrVar(ctCoordinator,ThectCoordinator),
72
73/* PostF01 */
74 msrNav([TheactCoordinator],
75     [init,[]],
76     [[ptBoolean,true]]),
77
78/* PostF02 */
79 msrNav([ThectCoordinator],
80     [init,[AdtCoordinatorID,AdtLogin,AdtPassword]],
81     [[ptBoolean,true]]),
82
83/* PostF03 */
84 msrNav([TheactCoordinator],
85     [msmAtPost,rnctCoordinator],
86     [ThectCoordinator]),
87
88/* PostF04 */
89  msrNav([ThectCoordinator],
90     [msmAtPost,rnactAuthenticated],
91     [TheactCoordinator]),
92
93/* PostF05 */
94  msrNav([TheActor],
95     [rnInterfaceIN,
96      ieCoordinatorAdded,[]],
97     [[ptBoolean,true]]),
98
99 /* Post Protocol:*/
100/* PostP01 */
101 true
102 .
```

Listing D.3: Prolog file outactAdministrator-oeAddCoordinator.pl.

D.4 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAdmin oeDeleteCoordinator.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----------------------------------------------------------
6msrop(outactAdministrator,
7   oeDeleteCoordinator,
8   [preProtocol,Self,
9    AdtCoordinatorID
10   ],
11  []):-
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actAdministrator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20    [vpStarted],
21    [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24    [rnctAuthenticated,vpIsLogged],
25    [[ptBoolean,true]])
26.
```

```
27
28msrop(outactAdministrator,
29   oeDeleteCoordinator,
30   [preFunctional,Self,
31    AdtCoordinatorID
32    ],
33   []):-
34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actAdministrator,TheActor),
37 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
38 msrNav([Self],[rnActor],[TheActor]),
39
40/* PreF01 */
41 msrNav([TheSystem],
42     [rnctCoordinator,
43     msrSelect,id,eq,[AdtCoordinatorID]],
44     ColctCoordinators),
45
46 msrNav(ColctCoordinators,
47     [msrSize,eq,[[ptInteger,1]]],
48     [[ptBoolean,true]]).
49
50msrop(outactAdministrator,
51   oeDeleteCoordinator,
52   [post,Self,
53    AdtCoordinatorID
54    ],
55    []):-
56
57/* Post Functional:*/
58 msrVar(ctState,TheSystem),
59 msrVar(actAdministrator,TheActor),
60 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
61 msrNav([Self],[rnActor],[TheActor]),
62
63/* PostF01 */
64 msrNav([TheSystem],
65    [rnctCoordinator,
66     msrSelect,id,eq,[AdtCoordinatorID]],
67    [ThectCoordinator]),
68
69 msrNav([ThectCoordinator],
70     [rnactCoordinator,msrForAll,msrIsKilled],
71     [[ptBoolean,true]]),
72
73 msrNav([ThectCoordinator],
74     [msrIsKilled],
75     [[ptBoolean,true]]),
76
77 /* PostF02 */
78 msrNav([TheActor],
79     [rnInterfaceIN,
80     ieCoordinatorDeleted,[]
81     ],
82     [[ptBoolean,true]]),
83
84 /* Post Protocol:*/
85/* PostP01 */
86 true
87 .
```

Listing D.4: Prolog file outactAdministrator-oeDeleteCoordinator.pl.

D.5 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAu oeLogin.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%-------------------------------------------------------
msrop(outactAuthenticated,
   oeLogin,
   [preProtocol,Self,
    AdtLogin,
    AdtPassword
    ],
   []):-
/* Pre Protocol:*/
 msrVar(ctState,TheSystem),
 msrVar(actAuthenticated,TheactAuthenticated),
 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
 msrNav([Self],[rnActor],[TheactAuthenticated]),

 /* PreP01 */
 msrNav([TheSystem],
    [vpStarted],
    [[ptBoolean,true]]),

 msrNav([TheactAuthenticated],
    [rnctAuthenticated,vpIsLogged],
    [[ptBoolean,false]])
 .

msrop(outactAuthenticated,
   oeLogin,
   [preFunctional,Self,
    AdtLogin,
    AdtPassword
    ],
   []):-
/* Pre Functional:*/
/* PreF01 */
true
.

msrop(outactAuthenticated,
   oeLogin,
   [post,Self,
    AdtLogin,
    AdtPassword
    ],
    []):-

 msrVar(ctState,TheSystem),
 msrVar(actAuthenticated,TheactAuthenticated),

 msrVar(ptString,AptStringMessageForTheactAuthenticated),
 msrVar(ptString,AptStringMessageForTheactAdministrator),

/* Post Functional:*/

 msrNav([Self],[rnActor],[TheactAuthenticated]),
 msrNav([Self],[rnActor,rnSystem],[TheSystem]),

/* PostF01 */

 ( (msrNav([TheactAuthenticated],
      [rnctAuthenticated,pwd],
      [AdtPassword]),
   msrNav([TheactAuthenticated],
      [rnctAuthenticated,login],
      [AdtLogin])
  )
 -> ( msrNav([AptStringMessageForTheactAuthenticated],
       [eq,[[ptString,'You are logged ! Welcome ...']]],
       [[ptBoolean,true]]),
```

```
72    msrNav([TheactAuthenticated],
73       [rnInterfaceIN,
74        ieMessage,[AptStringMessageForTheactAuthenticated]],
75       [[ptBoolean,true]])
76   )
77 ; ( msrNav([AptStringMessageForTheactAuthenticated],
78       [eq,[[ptString,'Wrong identification information ! Please try again ...']]],
79       [[ptBoolean,true]]),
80    msrNav([TheactAuthenticated],
81       [rnInterfaceIN,
82        ieMessage,[AptStringMessageForTheactAuthenticated]],
83       [[ptBoolean,true]]),
84
85    msrNav([AptStringMessageForTheactAdministrator],
86       [eq,[[ptString,'Intrusion tentative !']]],
87       [[ptBoolean,true]]),
88    msrNav([TheSystem],
89       [rnactAdministrator,rnInterfaceIN,
90        ieMessage,[AptStringMessageForTheactAdministrator]],
91       [[ptBoolean,true]])
92    )
93 ),
94
95 /* Post Protocol:*/
96/* PostP01 */
97 ( (msrNav([TheactAuthenticated],
98      [rnctAuthenticated,pwd],
99      [AdtPassword]),
100   msrNav([TheactAuthenticated],
101      [rnctAuthenticated,login],
102      [AdtLogin])
103  )
104 -> (msrNav([TheactAuthenticated],
105       [rnctAuthenticated,msmAtPost,vpIsLogged],
106       [[ptBoolean,true]])
107    )
108 ; true
109 )
110 .
```

Listing D.5: Prolog file outactAuthenticated-oeLogin.pl.

D.6 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAu oeLogout.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----------------------------------------------------------
6msrop(outactAuthenticated,
7   oeLogout,
8   [preProtocol,Self
9    ],
10   []):-
11/* Pre Protocol:*/
12 msrVar(ctState,TheSystem),
13 msrVar(actAuthenticated,TheActor),
14 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
15 msrNav([Self],[rnActor],[TheActor]),
16
17/* PreP01 */
18 msrNav([TheSystem],
19    [vpStarted],
20    [[ptBoolean,true]]),
21
22 msrNav([TheActor],
23    [rnctAuthenticated,vpIsLogged],
```

```
24     [[ptBoolean,true]])
25  .
26
27msrop(outactAuthenticated,
28    oeLogout,
29    [preFunctional,Self
30     ],
31    []):-
32/* Pre Functional:*/
33/* PreF01 */
34true
35.
36
37msrop(outactAuthenticated,
38    oeLogout,
39    [post,Self
40     ],
41     []):-
42
43 msrVar(ctState,TheSystem),
44 msrVar(actAuthenticated,TheactAuthenticated),
45
46 msrVar(ptString,AptStringMessageForTheactAuthenticated),
47
48/* Post Functional:*/
49 msrNav([Self],[rnActor],[TheactAuthenticated]),
50 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
51
52/* PostF01 */
53 msrNav([AptStringMessageForTheactAuthenticated],
54     [eq,[[ptString,'You are logged out ! Good Bye ...']]],
55     [[ptBoolean,true]]),
56 msrNav([TheactAuthenticated],
57     [rnInterfaceIN,
58      ieMessage,[AptStringMessageForTheactAuthenticated]],
59     [[ptBoolean,true]]),
60
61 /* Post Protocol:*/
62/* PostP01 */
63msrNav([TheactAuthenticated],
64     [rnctAuthenticated,msmAtPost,vpIsLogged],
65     [[ptBoolean,false]])
66.
```

Listing D.6: Prolog file outactAuthenticated-oeLogout.pl.

D.7 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactComC oeAlert.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----------------------------------------------------
6nico(A):-
7 trace,
8 write('here'),
9 write('\n').
10
11msrop(outactComCompany,
12    oeAlert,
13    [preProtocol,Self,
14     AetHumanKind,
15     AdtDate,
16     AdtTime,
17     AdtPhoneNumber,
18     AdtGPSLocation,
19     AdtComment
```

```
20     ],
21    []):-
22/* Pre Protocol:*/
23 msrVar(ctState,TheSystem),
24 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
25/* PreP01 */
26 msrNav([TheSystem],
27     [vpStarted],
28     [[ptBoolean,true]])
29 .
30
31msrop(outactComCompany,
32    oeAlert,
33    [preFunctional,Self,
34     AetHumanKind,
35     AdtDate,
36     AdtTime,
37     AdtPhoneNumber,
38     AdtGPSLocation,
39     AdtComment
40     ],
41    []):-
42/* Pre Functional:*/
43/* PreF01 */
44 msrVar(ctState,TheSystem),
45 msrNav([Self],
46      [msmAtPre,rnActor,rnSystem],
47      [TheSystem]),
48
49 ( msrNav([TheSystem],[clock,date,gt,[AdtDate]],[[ptBoolean,true]])
50  ; (msrNav([TheSystem],[clock,date,eq,[AdtDate]],[[ptBoolean,true]])
51   , msrNav([TheSystem],[clock,time,gt,[AdtTime]],[[ptBoolean,true]])
52   )
53 )
54.
55
56msrop(outactComCompany,
57    oeAlert,
58    [post,Self,
59     AetHumanKind,
60     AdtDate,
61     AdtTime,
62     AdtPhoneNumber,
63     AdtGPSLocation,
64     AdtComment
65     ],
66     []):-
67
68 msrVar(ctState,TheSystem),
69 msrVar(ctHuman,ActHuman),
70 msrVar(actComCompany,TheactComCompany),
71 msrVar(ctAlert,ActAlert),
72 msrVar(dtDateAndTime,AAlertInstant),
73 msrVar(etAlertStatus,AetAlertStatus),
74% msrVar(ctAlert,ActAlertNearBy),
75 msrVar(ctCrisis,ActCrisis),
76 msrVar(dtCrisisID,AdtCrisisID),
77% msrVar(etCrisisType,AetCrisisType),
78 msrVar(etCrisisStatus,AetCrisisStatus),
79 msrVar(dtDateAndTime,ACrisisInstant),
80 msrVar(dtComment,ACrisisdtComment),
81% msrVar(ptString,AptStringMessage),
82 msrVar(dtSMS,AdtSMS),
83 msrVar(dtAlertID,AdtAlertID),
84
85% msrVar(ptInteger,TheNextptIntegerValue),
86% msrVar(ptInteger,UpdatedNextptIntegerValue),
87% msrVar(inactComCompany,TheComCompanyIN),
88% msrVar(dtComment,TheCommentStored),
89% msrVar(dtString,TheCommentStoreddtString),
```

```
90
91/* Post Functional:*/
92
93 msrNav([Self],[rnActor],[TheactComCompany]),
94 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
95
96/* PostF01 */
97 msrNav([TheSystem],
98     [nextValueForAlertID],
99     [PrenextValueForAlertID]),
100 msrNav([PrenextValueForAlertID],
101     [add,[[dtInteger,[[value,[ptInteger,1]]],[]]]],
102     [PostnextValueForAlertID]),
103 msrNav([TheSystem],
104     [msmAtPost,nextValueForAlertID],
105     [PostnextValueForAlertID]),
106
107 /* PostF02 */
108 msrNav([AAlertInstant],[date],[AdtDate]),
109 msrNav([AAlertInstant],[time],[AdtTime]),
110
111 msrNav([AetAlertStatus],
112     [],
113     [[etAlertStatus,pending]]),
114
115 msrNav([TheSystem],
116     [nextValueForAlertID,
117     todtString,[],eq,[AdtAlertID]],
118     [[ptBoolean,true]]),
119
120 msrNav([ActAlert],
121     [init,[AdtAlertID,
122        AetAlertStatus,
123        AdtGPSLocation,
124        AAlertInstant,
125        AdtComment]],
126     [[ptBoolean,true]]),
127
128 /* PostF03 */
129 msrNav([TheSystem],
130     [rnctAlert,
131      msrSelect,location,isNearTo,[AdtGPSLocation]],
132      ColctAlertsNearBy),
133
134 ( (msrNav(ColctAlertsNearBy,
135      [msrIsEmpty],
136      [[ptBoolean,true]])
137   )
138 -> (
139    msrNav([TheSystem],
140       [nextValueForCrisisID],
141       [PrenextValueForCrisisID]),
142    msrNav([PrenextValueForCrisisID],
143       [add,[[dtInteger,[[value,[ptInteger,1]]],[]]]],
144       [PostnextValueForCrisisID]),
145    msrNav([TheSystem],
146       [msmAtPost,nextValueForCrisisID],
147       [PostnextValueForCrisisID]),
148
149   msrNav([TheSystem],
150       [nextValueForCrisisID,
151       todtString,[],eq,[AdtCrisisID]],
152       [[ptBoolean,true]]),
153
154   msrNav([AdtCrisisType],[],[[etCrisisType,small]]),
155   msrNav([AetCrisisStatus],[],[[etCrisisStatus,pending]]),
156   msrNav([ACrisisInstant],[],[AAlertInstant]),
157   msrNav([ACrisisdtComment],
158       [value],
159       [[ptString,'no reporting yet defined']]),
```

```
160   msrNav([ActCrisis],[init,[AdtCrisisID,
161                 AdtCrisisType,
162                 AetCrisisStatus,
163                 AdtGPSLocation,
164                 ACrisisInstant,
165                 ACrisisdtComment]],
166       [[ptBoolean,true]])
167
168    )
169 ; (
170   msrNav(ColctAlertsNearBy,
171      [rnTheCrisis,msrAny,msrTrue],
172      [ActCrisis])
173  )
174 ),
175
176 /* PostF04 */
177
178 msrNav([ActAlert],
179     [msmAtPost,rnTheCrisis],
180     [ActCrisis]),
181
182/* PostF05 */
183
184 msrNav([TheSystem],
185    [rnctHuman,
186     msrSelect,id,eq,[AdtPhoneNumber]],
187    HumanCol1),
188
189 msrNav(HumanCol1,
190    [msrSelect,kind,etEq,[AetHumanKind]],
191    HumanCol2),
192
193 (msrNav(HumanCol2,[msrIsEmpty],[[ptBoolean,true]])
194 -> (msrNav([ActHuman],
195       [init,[AdtPhoneNumber,AetHumanKind]],
196       [[ptBoolean,true]]),
197   msrNav([ActHuman],
198       [msmAtPost,rnactComCompany],
199       [TheactComCompany])
200   )
201 ; msrNav(HumanCol2,
202     [msrAny],
203     [ActHuman])
204 ),
205
206msrNav([ActHuman],
207    [rnSignaled,msrIncluding,[ActAlert]],
208    ColAlerts),
209
210msrNav([ActHuman],
211    [msmAtPost,rnSignaled],
212    ColAlerts),
213
214/* PostF06 */
215msrNav([AdtSMS],
216    [value],
217    [[ptString,'Your alert has been registered. We will handle it and keep you informed']]),
218msrNav([TheactComCompany],
219    [rnInterfaceIN,
220    ieSmsSend,[AdtPhoneNumber,
221          AdtSMS]],[[ptBoolean,true]]),
222
223/*
224
225 */
226
227 /* Post Protocol:*/
228/* PostP01 */
229 true
```

```
.
```

Listing D.7: Prolog file outactComCompany-oeAlert.pl.

D.8 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordi oeCloseCrisis.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%-----------------------------------------------------------
msrop(outactCoordinator,
   oeCloseCrisis,
   [preProtocol,Self,
    AdtCrisisID
    ],
   []):-
/* Pre Protocol:*/
 msrVar(ctState,TheSystem),
 msrVar(actCoordinator,TheActor),
 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
 msrNav([Self],[rnActor],[TheActor]),

/* PreP01 */
 msrNav([TheSystem],
    [vpStarted],
    [[ptBoolean,true]]),

/* PreP02 */
 msrNav([TheActor],
    [rnctAuthenticated,vpIsLogged],
    [[ptBoolean,true]])
.

msrop(outactCoordinator,
   oeCloseCrisis,
   [preFunctional,Self,
    AdtCrisisID
    ],
   []):-
/* Pre Functional:*/
 msrVar(ctState,TheSystem),
 msrVar(actCoordinator,TheActor),

 msrVar(dtCrisisID,AdtCrisisID),

 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
 msrNav([Self],[rnActor],[TheActor]),

/* PreF01 */
 msrNav([TheSystem],
    [rnctCrisis,
     msrSelect,
     id,eq,[AdtCrisisID]
    ],
    ColCrisis),

 msrNav(ColCrisis,
     [msrSize,eq,[[ptInteger,1]]],
     [[ptBoolean,true]])
 .

msrop(outactCoordinator,
   oeCloseCrisis,
   [post,Self,
    AdtCrisisID
    ],
```

```
62     []):-
63
64/* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actCoordinator,TheActor),
67
68 msrVar(ctCrisis,TheCrisis),
69 msrVar(dtCrisisID,AdtCrisisID),
70
71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
72 msrNav([Self],[rnActor],[TheActor]),
73
74/* PostF01 */
75 msrNav([TheSystem],
76    [rnctCrisis,
77     msrSelect,
78     id,eq,[AdtCrisisID]],
79    [TheCrisis]),
80
81 msrNav([TheCrisis],
82     [msmAtPost,status],
83     [[etCrisisStatus,closed]]),
84
85/* PostF02 */
86 msrNav([TheCrisis],
87     [msmAtPost,rnHandler],
88     []),
89
90 /* PostF03 */
91 msrNav([TheCrisis],
92     [rnAlerts,msrForAll,msrIsKilled],
93     [[ptBoolean,true]]),
94
95/* PostF04 */
96 msrNav([TheActor],
97     [rnInterfaceIN,
98     ieMessage,[[ptString,'The crisis is now closed !']]
99     ],
100    [[ptBoolean,true]]),
101
102/* Post Protocol:*/
103/* PostP01 */
104 true
105 .
```

Listing D.8: Prolog file outactCoordinator-oeCloseCrisis.pl.

D.9 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCo oeGetAlertsSet.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----------------------------------------------------------
6msrop(outactCoordinator,
7   oeGetAlertsSet,
8   [preProtocol,Self,
9    AetAlertStatus
10   ],
11   []):-
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
```

```
19 msrNav([TheSystem],
20    [vpStarted],
21    [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24    [rnctAuthenticated,vpIsLogged],
25    [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29   oeGetAlertsSet,
30   [preFunctional,Self,
31    AetAlertStatus
32    ],
33   []):-
34/* Pre Functional:*/
35/* PreF01 */
36true
37 .
38
39msrop(outactCoordinator,
40   oeGetAlertsSet,
41   [post,Self,
42    AetAlertStatus
43    ],
44    []):-
45
46/* Post Functional:*/
47 msrVar(ctState,TheSystem),
48 msrVar(actCoordinator,TheActor),
49 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
50 msrNav([Self],[rnActor],[TheActor]),
51
52/* PostF01 */
53 msrNav([TheSystem],
54    [rnctAlert,
55     msrSelect,
56     status,etEq,[AetAlertStatus]],
57    ColAlertSet),
58
59 msrNav(ColAlertSet,
60     [msrForAll,isSentToCoordinator,[TheActor]],
61     [[ptBoolean,true]]),
62
63 /* Post Protocol:*/
64/* PostP01 */
65 true
66 .
```

Listing D.9: Prolog file outactCoordinator-oeGetAlertsSet.pl.

D.10 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoor oeGetCrisisSet.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----------------------------------------------------
6msrop(outactCoordinator,
7   oeGetCrisisSet,
8   [preProtocol,Self,
9    AetCrisisStatus
10   ],
11   []):-
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
```

```
msrNav([Self],[rnActor,rnSystem],[TheSystem]),
msrNav([Self],[rnActor],[TheActor]),

/* PreP01 */
msrNav([TheSystem],
    [vpStarted],
    [[ptBoolean,true]]),

msrNav([TheActor],
    [rnctAuthenticated,vpIsLogged],
    [[ptBoolean,true]])
.

msrop(outactCoordinator,
   oeGetCrisisSet,
   [preFunctional,Self,
    AetCrisisStatus
    ],
   []):-
/* Pre Functional:*/
/* PreF01 */
true
 .

msrop(outactCoordinator,
   oeGetCrisisSet,
   [post,Self,
    AetCrisisStatus
    ],
    []):-

/* Post Functional:*/
msrVar(ctState,TheSystem),
msrVar(actCoordinator,TheActor),
msrNav([Self],[rnActor,rnSystem],[TheSystem]),
msrNav([Self],[rnActor],[TheActor]),

/* PostF01 */
msrNav([TheSystem],
    [rnctCrisis,
     msrSelect,
     status,etEq,[AetCrisisStatus]],
    ColCrisisSet),

msrNav(ColCrisisSet,
     [msrForAll,isSentToCoordinator,[TheActor]],
     [[ptBoolean,true]]),

 /* Post Protocol:*/
/* PostP01 */
 true
 .
```

Listing D.10: Prolog file outactCoordinator-oeGetCrisisSet.pl.

D.11 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactC oeInvalidateAlert.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%-----------------------------------------------------------
msrop(outactCoordinator,
   oeInvalidateAlert,
   [preProtocol,Self,
    AdtAlertID
    ],
```

```
11    []):-
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20    [vpStarted],
21    [[ptBoolean,true]]),
22
23/* PreP02 */
24 msrNav([TheActor],
25    [rnctAuthenticated,vpIsLogged],
26    [[ptBoolean,true]])
27.
28
29msrop(outactCoordinator,
30   oeInvalidateAlert,
31   [preFunctional,Self,
32    AdtAlertID
33    ],
34   []):-
35/* Pre Functional:*/
36 msrVar(ctState,TheSystem),
37 msrVar(actCoordinator,TheActor),
38
39 msrVar(dtAlertID,AdtAlertID),
40
41 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
42 msrNav([Self],[rnActor],[TheActor]),
43
44/* PreF01 */
45 msrNav([TheSystem],
46    [rnctAlert,
47     msrSelect,
48     id,eq,[AdtAlertID]
49    ],
50    ColAlert),
51
52 msrNav(ColAlert,
53     [msrSize,eq,[[ptInteger,1]]],
54     [[ptBoolean,true]])
55 .
56
57msrop(outactCoordinator,
58   oeInvalidateAlert,
59   [post,Self,
60    AdtAlertID
61    ],
62    []):-
63
64/* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actCoordinator,TheActor),
67
68 msrVar(ctAlert,TheAlert),
69 msrVar(dtAlertID,AdtAlertID),
70
71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
72 msrNav([Self],[rnActor],[TheActor]),
73
74/* PostF01 */
75 msrNav([TheSystem],
76    [rnctAlert,
77     msrSelect,
78     id,eq,[AdtAlertID]],
79    [TheAlert]),
80
```

```
msrNav([TheAlert],
    [msmAtPost,status],
    [[etAlertStatus,invalid]]),

/* PostF02 */
msrNav([TheActor],
    [rnInterfaceIN,
    ieMessage,[[ptString,'The alert is now declared as invalid !']]
    ],
    [[ptBoolean,true]]),

/* Post Protocol:*/
/* PostP01 */
true
.
```

Listing D.11: Prolog file outactCoordinator-oeInvalidateAlert.pl.

D.12 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactC oeReportOnCrisis.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%-------------------------------------------------------
msrop(outactCoordinator,
   oeReportOnCrisis,
   [preProtocol,Self,
    AdtCrisisID,
    AdtComment
    ],
   []):-
/* Pre Protocol:*/
msrVar(ctState,TheSystem),
msrVar(actCoordinator,TheActor),
msrNav([Self],[rnActor,rnSystem],[TheSystem]),
msrNav([Self],[rnActor],[TheActor]),

/* PreP01 */
msrNav([TheSystem],
    [vpStarted],
    [[ptBoolean,true]]),

msrNav([TheActor],
    [rnctAuthenticated,vpIsLogged],
    [[ptBoolean,true]])
.

msrop(outactCoordinator,
   oeReportOnCrisis,
   [preFunctional,Self,
    AdtCrisisID,
    AdtComment
    ],
   []):-
/* Pre Functional:*/
msrVar(ctState,TheSystem),
msrVar(actCoordinator,TheActor),

msrVar(dtCrisisID,AdtCrisisID),

msrNav([Self],[rnActor,rnSystem],[TheSystem]),
msrNav([Self],[rnActor],[TheActor]),

/* PreF01 */
msrNav([TheSystem],
    [rnctCrisis,
```

```
48      msrSelect,
49      id,eq,[AdtCrisisID]
50     ],
51     ColCrisis),
52
53 msrNav(ColCrisis,
54      [msrSize,eq,[[ptInteger,1]]],
55      [[ptBoolean,true]])
56 .
57
58msrop(outactCoordinator,
59   oeReportOnCrisis,
60   [post,Self,
61    AdtCrisisID,
62    AdtComment
63    ],
64    []):-
65
66/* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(dtComment,AdtComment),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77/* PostF01 */
78 msrNav([TheSystem],
79    [rnctCrisis,
80     msrSelect,
81     id,eq,[AdtCrisisID]],
82    [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost,comment],
86     [AdtComment]),
87
88 msrNav([TheActor],
89     [rnInterfaceIN,
90     ieMessage,[[ptString,'The crisis comment has been updated !']]
91     ],
92     [[ptBoolean,true]]),
93
94/* Post Protocol:*/
95/* PostP01 */
96 true
97 .
```

Listing D.12: Prolog file outactCoordinator-oeReportOnCrisis.pl.

D.13 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoor oeSetCrisisHandler.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----------------------------------------------------
6msrop(outactCoordinator,
7   oeSetCrisisHandler,
8   [preProtocol,Self,
9    AdtCrisisID
10    ],
11   []):-
12/* Pre Protocol:*/
```

```
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20    [vpStarted],
21    [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24    [rnctAuthenticated,vpIsLogged],
25    [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29   oeSetCrisisHandler,
30   [preFunctional,Self,
31    AdtCrisisID
32    ],
33   []):-
34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actCoordinator,TheActor),
37
38 msrVar(dtCrisisID,AdtCrisisID),
39
40 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
41 msrNav([Self],[rnActor],[TheActor]),
42
43/* PreF01 */
44 msrNav([TheSystem],
45    [rnctCrisis,
46     msrSelect,
47     id,eq,[AdtCrisisID]
48    ],
49    ColCrisis),
50
51 msrNav(ColCrisis,
52     [msrSize,eq,[[ptInteger,1]]],
53     [[ptBoolean,true]])
54 .
55
56msrop(outactCoordinator,
57   oeSetCrisisHandler,
58   [post,Self,
59    AdtCrisisID
60    ],
61    []):-
62
63/* Post Functional:*/
64 msrVar(ctState,TheSystem),
65 msrVar(actCoordinator,TheActor),
66 msrVar(ctCoordinator,TheCoordinator),
67 msrVar(ctCoordinator,TheCurrentHandler),
68
69 msrVar(ctCrisis,TheCrisis),
70 msrVar(dtCrisisID,AdtCrisisID),
71
72 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
73 msrNav([Self],[rnActor],[TheActor]),
74
75/* PostF01 */
76 msrNav([TheSystem],
77    [rnctCrisis,
78     msrSelect,
79     id,eq,[AdtCrisisID]],
80    [TheCrisis]),
81
82 msrNav([TheCrisis],
```

```
83      [msmAtPost,status],
84      [[etCrisisStatus,handled]]),
85
86  msrNav([TheActor],
87      [rnctCoordinator],
88      [TheCoordinator]),
89  msrNav([TheCrisis],
90      [msmAtPost,rnHandler],
91      [TheCoordinator]),
92
93  msrNav([TheActor],
94      [rnInterfaceIN,
95      ieMessage,[[ptString,'You are now considered as handling the crisis !']]
96      ],
97      [[ptBoolean,true]]),
98
99  /* PostF02 */
100 msrNav([TheCrisis],
101     [rnAlerts,msrForAll,isSentToCoordinator,[TheActor]],
102     [[ptBoolean,true]]),
103
104 /* PostF03 */
105 ( msrNav([TheCrisis],
106      [rnHandler,msrSize,eq,[[ptInteger,1]]],
107      [[ptBoolean,true]])
108  -> (msrNav([TheCrisis],
109        [rnHandler],
110        [TheCurrentHandler]),
111    msrNav([TheCurrentHandler],
112        [rnactCoordinator,rnInterfaceIN,
113        ieMessage,[[ptString,'One of the crisis you were handling is now handled by one of your
    colleagues!']]
114        ],
115        [[ptBoolean,true]])
116    )
117  ; true
118 ),
119
120  /* PostF04 */
121 msrNav([TheCrisis],
122     [rnAlerts,rnSignaler,msrForAll,isAcknowledged,[]],
123     [[ptBoolean,true]]),
124
125 /* Post Protocol:*/
126/* PostP01 */
127 true
128 .
```

Listing D.13: Prolog file outactCoordinator-oeSetCrisisHandler.pl.

D.14 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoor oeSetCrisisStatus.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----------------------------------------------------------
6msrop(outactCoordinator,
7   oeSetCrisisStatus,
8   [preProtocol,Self,
9    AdtCrisisID,
10   AetCrisisStatus
11   ],
12  []):-
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actCoordinator,TheActor),
```

```
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheActor]),
18
19/* PreP01 */
20 msrNav([TheSystem],
21    [vpStarted],
22    [[ptBoolean,true]]),
23
24 msrNav([TheActor],
25    [rnctAuthenticated,vpIsLogged],
26    [[ptBoolean,true]])
27.
28
29msrop(outactCoordinator,
30   oeSetCrisisStatus,
31   [preFunctional,Self,
32    AdtCrisisID,
33    AetCrisisStatus
34    ],
35   []):-
36/* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45/* PreF01 */
46 msrNav([TheSystem],
47    [rnctCrisis,
48     msrSelect,
49     id,eq,[AdtCrisisID]
50    ],
51    ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize,eq,[[ptInteger,1]]],
55     [[ptBoolean,true]])
56 .
57
58msrop(outactCoordinator,
59   oeSetCrisisStatus,
60   [post,Self,
61    AdtCrisisID,
62    AetCrisisStatus
63    ],
64    []):-
65
66/* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(etCrisisStatus,AetCrisisStatus),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77/* PostF01 */
78 msrNav([TheSystem],
79    [rnctCrisis,
80     msrSelect,
81     id,eq,[AdtCrisisID]],
82    [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost,status],
```

```
86      [AetCrisisStatus]),
87
88  msrNav([TheActor],
89      [rnInterfaceIN,
90      ieMessage,[[ptString,'The crisis status has been updated !']]
91      ],
92      [[ptBoolean,true]]),
93
94  /* Post Protocol:*/
95  /* PostP01 */
96  true
97  .
```

Listing D.14: Prolog file outactCoordinator-oeSetCrisisStatus.pl.

D.15 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoor oeSetCrisisType.pl

```
1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5 %-------------------------------------------------------
6 msrop(outactCoordinator,
7    oeSetCrisisType,
8    [preProtocol,Self,
9     AdtCrisisID,
10    AetCrisisType
11    ],
12   []):-
13 /* Pre Protocol:*/
14  msrVar(ctState,TheSystem),
15  msrVar(actCoordinator,TheActor),
16  msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17  msrNav([Self],[rnActor],[TheActor]),
18
19 /* PreP01 */
20  msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean,true]]),
23
24  msrNav([TheActor],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,true]])
27 .
28
29 msrop(outactCoordinator,
30    oeSetCrisisType,
31    [preFunctional,Self,
32     AdtCrisisID,
33     AetCrisisType
34     ],
35    []):-
36 /* Pre Functional:*/
37  msrVar(ctState,TheSystem),
38  msrVar(actCoordinator,TheActor),
39
40  msrVar(dtCrisisID,AdtCrisisID),
41
42  msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43  msrNav([Self],[rnActor],[TheActor]),
44
45 /* PreF01 */
46  msrNav([TheSystem],
47     [rnctCrisis,
48      msrSelect,
49      id,eq,[AdtCrisisID]
50     ],
```

```
51    ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize,eq,[[ptInteger,1]]],
55     [[ptBoolean,true]])
56 .
57
58msrop(outactCoordinator,
59   oeSetCrisisType,
60   [post,Self,
61    AdtCrisisID,
62    AetCrisisType
63    ],
64    []):-
65
66/* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(etCrisisType,AetCrisisType),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77/* PostF01 */
78 msrNav([TheSystem],
79    [rnctCrisis,
80     msrSelect,
81     id,eq,[AdtCrisisID]],
82    [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost,type],
86     [AetCrisisType]),
87
88 msrNav([TheActor],
89     [rnInterfaceIN,
90     ieMessage,[[ptString,'The crisis type has been updated !']]
91     ],
92     [[ptBoolean,true]]),
93
94/* Post Protocol:*/
95/* PostP01 */
96 true
97 .
```

Listing D.15: Prolog file outactCoordinator-oeSetCrisisType.pl.

D.16 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactC oeValidateAlert.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----------------------------------------------------------
6msrop(outactCoordinator,
7   oeValidateAlert,
8   [preProtocol,Self,
9    AdtAlertID
10    ],
11   []):-
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
```

```
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20    [vpStarted],
21    [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24    [rnctAuthenticated,vpIsLogged],
25    [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29   oeValidateAlert,
30   [preFunctional,Self,
31    AdtAlertID
32    ],
33   []):-
34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actCoordinator,TheActor),
37
38 msrVar(dtAlertID,AdtAlertID),
39
40 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
41 msrNav([Self],[rnActor],[TheActor]),
42
43/* PreF01 */
44 msrNav([TheSystem],
45    [rnctAlert,
46     msrSelect,
47     id,eq,[AdtAlertID]
48    ],
49    ColAlerts),
50
51 msrNav(ColAlerts,
52     [msrSize,eq,[[ptInteger,1]]],
53     [[ptBoolean,true]])
54 .
55
56msrop(outactCoordinator,
57   oeValidateAlert,
58   [post,Self,
59    AdtAlertID
60    ],
61    []):-
62
63/* Post Functional:*/
64 msrVar(ctState,TheSystem),
65 msrVar(actCoordinator,TheActor),
66
67 msrVar(ctAlert,TheAlert),
68 msrVar(dtAlertID,AdtAlertID),
69
70 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
71 msrNav([Self],[rnActor],[TheActor]),
72
73/* PostF01 */
74 msrNav([TheSystem],
75    [rnctAlert,
76     msrSelect,
77     id,eq,[AdtAlertID]],
78    [TheAlert]),
79
80 msrNav([TheAlert],
81     [msmAtPost,status],
82     [[etAlertStatus,valid]]),
83
84 msrNav([TheActor],
85     [rnInterfaceIN,
```

```
86      ieMessage,[[ptString,'The Alert is now declared as valid !']]
87      ],
88      [[ptBoolean,true]]),
89
90  /* Post Protocol:*/
91 /* PostP01 */
92  true
93  .
```

Listing D.16: Prolog file outactCoordinator-oeValidateAlert.pl.

D.17 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactM oeCreateSystemAndEnvironment.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5/*
6/**************************************
7MSRCreatorActor
8**************************************/
9
10/*** createSystemAndEnvironment ***/
11
12msrop(outactMsrCreator,
13    oeCreateSystemAndEnvironment,
14    [preFunctional,_Self,_AqtyComCompanies],
15    []):-
16  true.
17
18msrop(outactMsrCreator,
19    oeCreateSystemAndEnvironment,
20    [preProtocol,_Self,_AqtyComCompanies],
21    []):-
22  true.
23
24msrop(outactMsrCreator,
25    oeCreateSystemAndEnvironment,
26    [post,_Self,AqtyComCompanies],
27    []):-
28
29  msrVar(ctState,TheSystem),
30  msrVar(actMsrCreator,AactMsrCreator),
31  msrVar(actAdministrator,AactAdministrator),
32
33  msrVar(dtInteger, AnextValueForAlertID),
34  msrVar(dtInteger, AnextValueForCrisisID),
35  msrVar(dtDateAndTime, Aclock),
36  msrVar(dtSecond, AcrisisReminderPeriod),
37  msrVar(dtSecond, AmaxCrisisReminderPeriod),
38  msrVar(ptBoolean, AvpStarted),
39
40  /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
41  msrNav([AnextValueForAlertID],
42      [value,eq,[[ptInteger,1]]],
43      [[ptBoolean,true]]),
44
45  msrNav([AnextValueForCrisisID],
46      [value,eq,[[ptInteger,1]]],
47      [[ptBoolean,true]]),
48
49 msrNav([Aclock],
50     [date,year,value],
51     [[ptInteger,1970]]),
52 msrNav([Aclock],
53     [date,month,value],
54     [[ptInteger,01]]),
```

```
55msrNav([Aclock],
56     [date,day,value],
57     [[ptInteger,01]]),
58
59msrNav([Aclock],
60     [time,hour,value],
61     [[ptInteger,00]]),
62msrNav([Aclock],
63     [time,minute,value],
64     [[ptInteger,00]]),
65msrNav([Aclock],
66     [time,second,value],
67     [[ptInteger,00]]),
68
69 msrNav([AcrisisReminderPeriod],
70      [value,eq,[[ptInteger,300]]],
71      [[ptBoolean,true]]),
72
73 msrNav([AmaxCrisisReminderPeriod],
74      [value,eq,[[ptInteger,1200]]],
75      [[ptBoolean,true]]),
76
77 msrNav([AvpStarted],
78      [],
79      [[ptBoolean,true]]),
80
81 msrNav([TheSystem],
82      [init,[AnextValueForAlertID,
83         AnextValueForCrisisID,
84         Aclock,
85         AcrisisReminderPeriod,
86         AmaxCrisisReminderPeriod,
87         Aclock,
88         AvpStarted]
89         ],
90      [[ptBoolean,true]]),
91
92/* PostF02*/
93 msrNav([AactMsrCreator],
94      [init,[]],
95      [[ptBoolean,true]]),
96
97 /* PostF03 */
98 msrVarCol(actComCompany,AqtyComCompanies,AactComCompanyCol),
99
100 msrNav(AactComCompanyCol,
101      [msrForAll,init,[]],
102      [[ptBoolean,true]]),
103
104 /* PostF04*/
105 msrNav([AactAdministrator],
106      [init,[]],
107      [[ptBoolean,true]]),
108
109 /* PostF05*/
110 msrVar(actActivator,AactActivator),
111 msrNav([AactActivator],
112      [init,[]],
113      [[ptBoolean,true]]),
114
115/* PostF06 */
116 msrVar(ctAdministrator,ActAdministrator),
117 msrVar(dtLogin,AdtLogin),
118 msrVar(dtPassword,AdtPassword),
119
120 msrNav([AdtLogin],
121      [value,eq,[[ptString,'icrashadmin']]],
122      [[ptBoolean,true]]),
123
124 msrNav([AdtPassword],
```

```
125     [value,eq,[[ptString,'7WXC1359']]],
126     [[ptBoolean,true]]),
127
128 msrNav([ActAdministrator],
129     [init,[AdtLogin,AdtPassword]],
130     [[ptBoolean,true]]),
131
132 /* PostF07*/
133 msrNav([ActAdministrator],
134     [msmAtPost,rnactAuthenticated],
135     [AactAdministrator]),
136
137/* Post Protocol:*/
138/* PostP01 */
139true
140.
```

Listing D.17: Prolog file outactMsrCreator-oeCreateSystemAndEnvironment.pl.

D.18 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla ctAdministrator-init.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctAdministrator,init,[Self,
7          Alogin,
8          Apwd],
9   Result):-
10(
11msrVar(ctAdministrator,Self),
12
13/* Post F01 */
14msrNav([Self],[login],[Alogin]),
15msrNav([Self],[pwd],[Apwd]),
16msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),
17
18/* Post F02 */
19 msrNav([Self],[msrIsNew],[Self])
20)
21-> Result = [ptBoolean,true]
22; Result = [ptBoolean,false]
23.
```

Listing D.18: Prolog file PrimaryTypesClasses-ctAdministrator-init.pl.

D.19 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla ctAlert-init.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctAlert,init,[Self,
7          Aid,
8          Astatus,
9          Alocation,
10         Ainstant,
11         Acomment],
12  Result):-
13
14/* Post F01 */
15(
```

```
msrVar(ctAlert,Self),

msrNav([Self],[id],[Aid]),
msrNav([Self],[status],[Astatus]),
msrNav([Self],[location],[Alocation]),
msrNav([Self],[instant],[Ainstant]),
msrNav([Self],[comment],[Acomment]),

/* Post F02 */
 msrNav([Self],[msrIsNew],[Self])
)
-> Result = [ptBoolean,true]
; Result = [ptBoolean,false]
.
```

Listing D.19: Prolog file PrimaryTypesClasses-ctAlert-init.pl.

D.20 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses ctAlert-isSentToCoordinator.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

msrop(ctAlert,isSentToCoordinator,[Self,AactCoordinator],
   Result):-

/* Post F01 */
(
 msrNav([AactCoordinator],
     [rnInterfaceIN,ieSendAnAlert,[Self]],
     [[ptBoolean,true]])
)
-> Result = [ptBoolean,true]
; Result = [ptBoolean,false]
.
```

Listing D.20: Prolog file PrimaryTypesClasses-ctAlert-isSentToCoordinator.pl.

D.21 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses ctAuthenticated-init.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

msrop(ctAuthenticated,init,[Self,
              Alogin,
              Apwd],
   Result):-

/* Post F01 */
(
msrVar(ctAuthenticated,Self),

msrNav([Self],[login],[Alogin]),
msrNav([Self],[pwd],[Apwd]),
msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),

/* Post F02 */
 msrNav([Self],[msrIsNew],[Self])
)
-> Result = [ptBoolean,true]
; Result = [ptBoolean,false]
```

```
24.
```

Listing D.21: Prolog file PrimaryTypesClasses-ctAuthenticated-init.pl.

D.22 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla ctCoordinator-init.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCoordinator,init,[Self,
7          Aid,
8          Alogin,
9          Apwd],
10   Result):-
11
12/* Post F01 */
13(
14msrVar(ctCoordinator,Self),
15
16msrNav([Self],[id],[Aid]),
17msrNav([Self],[login],[Alogin]),
18msrNav([Self],[pwd],[Apwd]),
19msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),
20
21/* Post F02 */
22 msrNav([Self],[msrIsNew],[Self])
23)
24-> Result = [ptBoolean,true]
25; Result = [ptBoolean,false]
26.
```

Listing D.22: Prolog file PrimaryTypesClasses-ctCoordinator-init.pl.

D.23 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla ctCrisis-handlingDelayPassed.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,handlingDelayPassed,[Self],
7   Result):-
8
9/* Post F01 */
10(
11 msrVar(ctState,TheSystem),
12 msrVar(dtInteger,CurrentClockSecondsQty),
13 msrVar(dtInteger,LastReminderSecondsQty),
14 msrVar(dtSecond,CrisisReminderPeriod),
15
16 msrNav([Self],[rnSystem],[TheSystem]),
17
18 msrNav([Self],
19     [status],
20     [[etCrisisStatus,pending]]),
21
22 msrNav([TheSystem],
23    [clock,toSecondsQty,[]],
24    [CurrentClockSecondsQty]),
25
26 msrNav([TheSystem],
27    [vpLastReminder,toSecondsQty,[]],
```

```
28     [LastReminderSecondsQty]),
29
30 msrNav([TheSystem],
31     [crisisReminderPeriod],
32     [CrisisReminderPeriod]),
33
34 msrNav([CurrentClockSecondsQty],
35     [sub,[LastReminderSecondsQty],
36      gt, [CrisisReminderPeriod]
37      ],
38     [[ptBoolean,true]])
39
40)
41-> Result = [ptBoolean,true]
42; Result = [ptBoolean,false]
43.
```

Listing D.23: Prolog file PrimaryTypesClasses-ctCrisis-handlingDelayPassed.pl.

D.24 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses ctCrisis-init.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,init,[Self,
7          Aid,
8          Atype,
9          Astatus,
10         Alocation,
11         Ainstant,
12         Acomment],
13   Result):-
14
15/* Post F01 */
16(
17msrVar(ctCrisis,Self),
18
19msrNav([Self],[id],[Aid]),
20msrNav([Self],[type],[Atype]),
21msrNav([Self],[status],[Astatus]),
22msrNav([Self],[location],[Alocation]),
23msrNav([Self],[instant],[Ainstant]),
24msrNav([Self],[comment],[Acomment]),
25
26/* Post F02 */
27 msrNav([Self],[msrIsNew],[Self])
28)
29-> Result = [ptBoolean,true]
30; Result = [ptBoolean,false]
31.
```

Listing D.24: Prolog file PrimaryTypesClasses-ctCrisis-init.pl.

D.25 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses ctCrisis-isAllocatedIfPossible.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,isAllocatedIfPossible,[Self],
7   Result):-
```

```
(
msrVar(ctState,TheSystem),
msrNav([Self],[rnSystem],[TheSystem]),

msrVar(actCoordinator,TheCoordinatorActor),
msrVar(ctCoordinator,TheCoordinator),
msrVar(ptString,TheMessage),
msrVar(ptString,TheCrisisIDptString),

(
/* Post F01 */
msrNav([Self],
    [maxHandlingDelayPassed,[]],
    [[ptBoolean,true]]),

( msrNav([TheSystem],
     [rnactCoordinator,msrIsEmpty],
     [[ptBoolean,false]])
 -> (
    /* Post F02 */
    msrNav([TheSystem],
       [rnactCoordinator,msrAny,msrTrue],
       [TheCoordinatorActor]),

    msrNav([TheCoordinatorActor],
        [rnctCoordinator],
        [TheCoordinator]),

    msrNav([Self],
        [msmAtPost,rnHandler],
        [TheCoordinator]),

     msrNav([Self],
        [msmAtPost,status],
        [[etCrisisStatus,handled]]),

     msrNav([Self],
        [id,value],
        [TheCrisisIDptString]),

    msrNav([[ptString,'You are now considered as handling the crisis having ID: ']],
        [ptStringConcat,[TheCrisisIDptString]],
        [TheMessage]),

    msrNav([TheCoordinatorActor],
        [rnInterfaceIN,
        ieMessage,[TheMessage]
        ],
        [[ptBoolean,true]])
   )
; ( /* Post F03 */
   msrNav([TheSystem],
      [rnactAdministrator,msrForAll,rnInterfaceIN,
      ieMessage,[[ptString,'Please add new coordinators to handle pending crisis !']]],
      [[ptBoolean,true]])
 )
)
)
)
-> Result = [ptBoolean,true]
; Result = [ptBoolean,false]
.
```

Listing D.25: Prolog file PrimaryTypesClasses-ctCrisis-isAllocatedIfPossible.pl.

D.26 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla ctCrisis-isSentToCoordinator.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

```
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,isSentToCoordinator,[Self,AactCoordinator],
7   Result):-
8
9/* Post F01 */
10(
11 msrNav([AactCoordinator],
12     [rnInterfaceIN,ieSendACrisis,[Self]],
13     [[ptBoolean,true]])
14)
15-> Result = [ptBoolean,true]
16; Result = [ptBoolean,false]
17.
```

Listing D.26: Prolog file PrimaryTypesClasses-ctCrisis-isSentToCoordinator.pl.

D.27 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses ctCrisis-maxHandlingDelayPassed.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,maxHandlingDelayPassed,[Self],
7   Result):-
8
9/* Post F01 */
10(
11 msrVar(ctState,TheSystem),
12 msrVar(dtInteger,CurrentClockSecondsQty),
13 msrVar(dtInteger,CrisisInstantSecondsQty),
14 msrVar(dtSecond,MaxCrisisReminderPeriod),
15
16 msrNav([Self],[rnSystem],[TheSystem]),
17
18 msrNav([Self],
19     [status],
20     [[etCrisisStatus,pending]]),
21
22 msrNav([TheSystem],
23    [clock,toSecondsQty,[]],
24    [CurrentClockSecondsQty]),
25
26 msrNav([Self],
27    [instant,toSecondsQty,[]],
28    [CrisisInstantSecondsQty]),
29
30 msrNav([TheSystem],
31    [maxCrisisReminderPeriod],
32    [MaxCrisisReminderPeriod]),
33
34 msrNav([CurrentClockSecondsQty],
35    [sub,[CrisisInstantSecondsQty],
36     gt, [MaxCrisisReminderPeriod]
37     ],
38    [[ptBoolean,true]])
39
40)
41-> Result = [ptBoolean,true]
42; Result = [ptBoolean,false]
43.
```

Listing D.27: Prolog file PrimaryTypesClasses-ctCrisis-maxHandlingDelayPassed.pl.

D.28 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla ctHuman-init.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

msrop(ctHuman,init,[Self,
          Aid,
          Akind],
   Result):-

/* Post F01 */
(
msrVar(ctHuman,Self),

msrNav([Self],[id],[Aid]),
msrNav([Self],[kind],[Akind]),

/* Post F02 */
 msrNav([Self],[msrIsNew],[Self])
)
-> Result = [ptBoolean,true]
; Result = [ptBoolean,false]
.
```

Listing D.28: Prolog file PrimaryTypesClasses-ctHuman-init.pl.

D.29 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla ctHuman-isAcknowledged.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

msrop(ctHuman,isAcknowledged,[Self],Result):-

/* Post F01 */
(msrVar(dtPhoneNumber,AdtPhoneNumber),
 msrVar(dtSMS,AdtSMS),

 msrNav([Self],
     [id,eq,[AdtPhoneNumber]],
     [[ptBoolean,true]]),
 msrNav([AdtSMS],
     [value,eq,[[ptString,'The handling of your alert by our services is in progress !']]],
     [[ptBoolean,true]]),
 msrNav([Self],
     [rnactComCompany,rnInterfaceIN,ieSmsSend,[AdtPhoneNumber,AdtSMS]],
     [[ptBoolean,true]])
)
-> Result = [ptBoolean,true]
; Result = [ptBoolean,false]
.
```

Listing D.29: Prolog file PrimaryTypesClasses-ctHuman-isAcknowledged.pl.

D.30 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla ctState-init.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

msrop(ctState,init,[Self,
          AnextValueForAlertID,
          AnextValueForCrisisID,
          Aclock,
          AcrisisReminderPeriod,
          AmaxCrisisReminderPeriod,
          AvpLastReminder,
          AvpStarted],
   Result):-

/* Post F01 */
(
 msrVar(ctState,Self),

 msrNav([Self],[nextValueForAlertID],[AnextValueForAlertID]),
 msrNav([Self],[nextValueForCrisisID],[AnextValueForCrisisID]),
 msrNav([Self],[clock],[Aclock]),
 msrNav([Self],[crisisReminderPeriod],[AcrisisReminderPeriod]),
 msrNav([Self],[maxCrisisReminderPeriod],[AmaxCrisisReminderPeriod]),
 msrNav([Self],[vpLastReminder],[AvpLastReminder]),
 msrNav([Self],[vpStarted],[AvpStarted]),

 msrNav([Self],[msrIsNew],[Self])
)
-> Result = [ptBoolean,true]
; Result = [ptBoolean,false]
.
```

Listing D.30: Prolog file PrimaryTypesClasses-ctState-init.pl.

D.31 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataty dtAlertID-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

msrop(dtAlertID,is,[AdtValue],Result):-
% msd01
msrVar(ptBoolean,TheResult),
(
 ( msrNav([AdtValue],
    [value,length,[],gt,[[ptInteger,0]]],
    [[ptBoolean,true]]),
   msrNav([AdtValue],
    [value,length,[],leq,[[ptInteger,20]]],
    [[ptBoolean,true]])
 )
 -> (TheResult = [ptBoolean,true])
 ; (TheResult = [ptBoolean,false])
),
TheResult = Result
.

/*
| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]],[]]]],
msrNav([X],[is,[]],[Result]).

X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]],[]]]],
Result = [ptBoolean,true] ?

yes

| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'012345678901234567890123456789']]],[]]]],
msrNav([X],[is,[]],[Result]).
```

```
34
35X = [dtAlertID,[],[[dtString,[[value,[ptString,'01234567890123456789012345678 9']]],[]]]],
36Result = [ptBoolean,false] ?
37
38yes
39*/
```

Listing D.31: Prolog file PrimaryTypesDatatypes-dtAlertID-is.pl.

D.32 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDat dtComment-is.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtComment,is,[AdtValue],Result):-
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11(
12  (
13    (
14     MaxLength = [ptInteger,160],
15     msrNav([AdtValue],
16        [value,length,[],leq,[MaxLength]],
17        [[ptBoolean,true]])
18    )
19     -> TheResult = [ptBoolean,true]
20     ; TheResult = [ptBoolean,false]
21  )
22),
23 Result = TheResult
24.
25
26/*
27| ?- X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg ! Please help ...']]],[]]]],
28msrNav([X],[is,[]],[Result]).
29X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg ! Please help ...']]],[]]]],
30Result = [ptBoolean,true] ?
31yes
32
33| ?- X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg when I was running with my dog
      to go to the skate park because my friends called me on my mobile phone and told me that a skate
       star was doing triple back flips.']]],[]]]],
34msrNav([X],[is,[]],[Result]).
35X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg when I was running with my dog to go
      to the skate park because my friends called me on my mobile phone and told me that a skate star
      was doing triple back flips.']]],[]]]],
36Result = [ptBoolean,false] ?
37yes
38*/
```

Listing D.32: Prolog file PrimaryTypesDatatypes-dtComment-is.pl.

D.33 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDat dtCoordinatorID-is.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(dtCoordinatorID,is,[AdtValue],Result):-
```

```
% msd01
 msrVar(ptBoolean,TheResult),
(
 ( msrNav([AdtValue],
    [value,length,[],gt,[[ptInteger,0]]],
    [[ptBoolean,true]]),
  msrNav([AdtValue],
    [value,length,[],leq,[[ptInteger,5]]],
    [[ptBoolean,true]])
 )
 -> (TheResult = [ptBoolean,true])
 ; (TheResult = [ptBoolean,false])
),
TheResult = Result
.
```

Listing D.33: Prolog file PrimaryTypesDatatypes-dtCoordinatorID-is.pl.

D.34 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataty dtCrisisID-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

msrop(dtCrisisID,is,[AdtValue],Result):-
% msd01
 msrVar(ptBoolean,TheResult),
(
 ( msrNav([AdtValue],
    [value,length,[],gt,[[ptInteger,0]]],
    [[ptBoolean,true]]),
  msrNav([AdtValue],
    [value,length,[],leq,[[ptInteger,10]]],
    [[ptBoolean,true]])
 )
 -> (TheResult = [ptBoolean,true])
 ; (TheResult = [ptBoolean,false])
),
TheResult = Result
.
/*
| ?- X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789']]],[]]]],
msrNav([X],[is,[]],[Result]).
X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789']]],[]]]],
Result = [ptBoolean,true] ?
yes

| ?- X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789a']]],[]]]],
msrNav([X],[is,[]],[Result]).
X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789a']]],[]]]],
Result = [ptBoolean,false] ?
yes
*/
```

Listing D.34: Prolog file PrimaryTypesDatatypes-dtCrisisID-is.pl.

D.35 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataty dtGPSLocation-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

```

```
%% dtPhoneNumber

% msd01
msrop(dtGPSLocation,is,[AdtValue],Result):-
msrVar(ptBoolean,TheResult),
(
  (
     msrNav([AdtValue],
        [latitude,is,[]],
        [[ptBoolean,true]]),
     msrNav([AdtValue],
        [longitude,is,[]],
        [[ptBoolean,true]])
  )
 -> TheResult = [ptBoolean,true]
 ; TheResult = [ptBoolean,false]
),

 Result = TheResult
.
```

Listing D.35: Prolog file PrimaryTypesDatatypes-dtGPSLocation-is.pl.

D.36 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDat dtGPSLocation-isNearTo.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%% dtGPSLocation

msrop(dtGPSLocation,isNearTo,[Self,AdtValue],Result):-
msrVar(ptBoolean,TheResult),
msrVar(dtReal,EarthRadius),
msrVar(dtReal,MaxDistance),

msrVar(dtLatitude,ComparedLatitude),
msrVar(dtLongitude,ComparedLongitude),

msrVar(dtReal,R1),msrVar(dtReal,R1a),
msrVar(dtReal,R2),msrVar(dtReal,R2a),

(
  (
    (
     % msd01
     msrNav([EarthRadius],[value],[[ptReal,6371]]),
     msrNav([MaxDistance],[value],[[ptReal,100]]),

     msrNav([AdtValue],[latitude],[ComparedLatitude]),
     msrNav([AdtValue],[longitude],[ComparedLongitude]),

     msrNav([Self],[latitude,sin,[]],[R1a]),
     msrNav([AdtValue],[latitude,sin,[],mul,[R1a]],[R1]),

     msrNav([Self],[latitude,cos,[]],[R2a]),
     msrNav([AdtValue],[latitude,cos,[],mul,[R2a]],[R2]),

     msrNav([AdtValue],[longitude],[ComparedLongitude]),
     msrNav([Self],[longitude,sub,[ComparedLongitude],cos,[],mul,[R2],
            add,[R1],
            acos,[],
            mul,[EarthRadius],
            sub,[MaxDistance],
            value,leq,[[ptReal,0]]],
        [[ptBoolean,true]])
```

```
43     )
44      -> TheResult = [ptBoolean,true]
45      ; TheResult = [ptBoolean,false]
46   )
47),
48 Result = TheResult
49.
```

Listing D.36: Prolog file PrimaryTypesDatatypes-dtGPSLocation-isNearTo.pl.

D.37 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataty dtLatitude-is.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6% msd01
7msrop(dtLatitude,is,[AdtValue],Result):-
8msrVar(ptBoolean,TheResult),
9(
10  ( msrNav([AdtValue],
11      [value,geq,[[ptReal,-90.0]]],
12      [[ptBoolean,true]]),
13    msrNav([AdtValue],
14      [value,leq,[[ptReal,+90.0]]],
15      [[ptBoolean,true]])
16  )
17  -> (TheResult = [ptBoolean,true])
18  ; (TheResult = [ptBoolean,false])
19),
20Result = TheResult
21.
```

Listing D.37: Prolog file PrimaryTypesDatatypes-dtLatitude-is.pl.

D.38 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataty dtLogin-is.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtLogin,is,[AdtValue],Result):-
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11(
12   (
13     (
14      MaxLength = [ptInteger,20],
15      msrNav([AdtValue],
16         [value,length,[],leq,[MaxLength]],
17         [[ptBoolean,true]])
18     )
19      -> TheResult = [ptBoolean,true]
20      ; TheResult = [ptBoolean,false]
21   )
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567']]],[]]]],
```

```
msrNav([X],[is,[]],[Result]).
X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567']]],[]]]],
Result = [ptBoolean,true] ?
yes

| ?- X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567a']]],[]]]],
msrNav([X],[is,[]],[Result]).
X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567a']]],[]]]],
Result = [ptBoolean,false] ?
yes
*/
```

Listing D.38: Prolog file PrimaryTypesDatatypes-dtLogin-is.pl.

D.39 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDat dtLongitude-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%% dtPhoneNumber

% msd01
msrop(dtLongitude,is,[AdtValue],Result):-
msrVar(ptBoolean,TheResult),
(
 ( msrNav([AdtValue],
    [value,geq,[[ptReal,-180.0]]],
    [[ptBoolean,true]]),
   msrNav([AdtValue],
    [value,leq,[[ptReal,+180.0]]],
    [[ptBoolean,true]])
 )
 -> (TheResult = [ptBoolean,true])
 ; (TheResult = [ptBoolean,false])
),

 Result = TheResult
.
```

Listing D.39: Prolog file PrimaryTypesDatatypes-dtLongitude-is.pl.

D.40 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDat dtPassword-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%% dtComment

%msd01
msrop(dtPassword,is,[AdtValue],Result):-
 msrVar(ptBoolean,TheResult),
 msrVar(ptInteger,MinLength),
(
  (
    (
     MinLength = [ptInteger,6],
     msrNav([AdtValue],
        [value,length,[],geq,[MinLength]],
        [[ptBoolean,true]])
    )
     -> TheResult = [ptBoolean,true]
```

```
    ; TheResult = [ptBoolean,false]
  )
),
 Result = TheResult
.
/*
| ?- X = [dtPassword,[],[[dtString,[[value,[ptString,'012345']]],[]]]],
msrNav([X],[is,[]],[Result]).
X = [dtPassword,[],[[dtString,[[value,[ptString,'012345']]],[]]]],
Result = [ptBoolean,true] ?
yes

| ?- X = [dtPassword,[],[[dtString,[[value,[ptString,'01234']]],[]]]],
msrNav([X],[is,[]],[Result]).
X = [dtPassword,[],[[dtString,[[value,[ptString,'01234']]],[]]]],
Result = [ptBoolean,false] ?
yes
*/
```

Listing D.40: Prolog file PrimaryTypesDatatypes-dtPassword-is.pl.

D.41 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataty dtPhoneNumber-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%% dtPhoneNumber

% msd01
msrop(dtPhoneNumber,is,[AdtValue],Result):-
msrVar(ptBoolean,TheResult),
(
 ( msrNav([AdtValue],
    [value,length,[],gt,[[ptInteger,4]]],
    [[ptBoolean,true]]),
   msrNav([AdtValue],
    [value,length,[],leq,[[ptInteger,30]]],
    [[ptBoolean,true]])
 )

 -> TheResult = [ptBoolean,true]
 ; TheResult = [ptBoolean,false]
),
 Result = TheResult
.
/*
| ?- X = [dtPhoneNumber,[],[[dtString,[[value,[ptString,'(+352) 46 66 44 60 00']]],[]]]],
msrNav([X],[is,[]],[Result]).

X = [dtPhoneNumber,[],[[dtString,[[value,[ptString,'(+352) 46 66 44 60 00']]],[]]]],

Result = [ptBoolean,true] ?

yes
*/
```

Listing D.41: Prolog file PrimaryTypesDatatypes-dtPhoneNumber-is.pl.

D.42 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses etAlertStatus-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
```

```
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%% etAlertStatus

% msd01
msrop(etAlertStatus,is,[AdtValue],Result):-
msrVar(ptBoolean,TheResult),
(
  (
     member(AdtValue,[pending, valid, invalid])
  )
 -> TheResult = [ptBoolean,true]
 ; TheResult = [ptBoolean,false]
),
 Result = TheResult
.
```

Listing D.42: Prolog file PrimaryTypesDatatypes-etAlertStatus-is.pl.

D.43 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla etCrisisStatus-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%% etCrisisStatus

% msd01
msrop(etCrisisStatus,is,[AdtValue],Result):-
msrVar(ptBoolean,TheResult),
(
  (
     member(AdtValue,[pending, handled, solved, closed])
  )
 -> TheResult = [ptBoolean,true]
 ; TheResult = [ptBoolean,false]
),
 Result = TheResult
.
```

Listing D.43: Prolog file PrimaryTypesDatatypes-etCrisisStatus-is.pl.

D.44 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla etCrisisType-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%% etCrisisType

% msd01
msrop(etCrisisType,is,[AdtValue],Result):-
msrVar(ptBoolean,TheResult),
(
  (
     member(AdtValue,[small, medium, huge])
  )
 -> TheResult = [ptBoolean,true]
 ; TheResult = [ptBoolean,false]
),
 Result = TheResult
```

```
19.
```

Listing D.44: Prolog file PrimaryTypesDatatypes-etCrisisType-is.pl.

D.45 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses etHumanKind-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%% etHumanKind

% msd01
msrop(etHumanKind,is,[AdtValue],Result):-
msrVar(ptBoolean,TheResult),
(
  (
     member(AdtValue,[witness,victim,anonymous])
  )
 -> TheResult = [ptBoolean,true]
 ; TheResult = [ptBoolean,false]
),
 Result = TheResult
.
```

Listing D.45: Prolog file PrimaryTypesDatatypes-etHumanKind-is.pl.

D.46 File ./src-gen/prolog-ref-spec/Operations/Concepts/SecondaryTypesDatat dtSMS-is.pl

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
/* DISCONTIGUOUS PREDICATES */
:- multifile msrop/4.
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%% dtComment

%msd01
msrop(dtSMS,is,[AdtValue],Result):-
 msrVar(ptBoolean,TheResult),
 msrVar(ptInteger,MaxLength),
(
  (
    (
     MaxLength = [ptInteger,160],
     msrNav([AdtValue],
        [value,length,[],leq,[MaxLength]],
        [[ptBoolean,true]])
    )
     -> TheResult = [ptBoolean,true]
     ; TheResult = [ptBoolean,false]
  )
),
 Result = TheResult
.
```

Listing D.46: Prolog file SecondaryTypesDatatypes-dtSMS-is.pl.

Glossary

abstract actor an actor that is not 22

actor An actor is a person, organization, or external system that plays a role in one or more interactions with the system 18

direct actor an actor that interacts directly with the system. It thus belongs to the environment. 22

indirect actor an actor that interacts indirectly with the system through a direct actor. It thus belongs the domain but not to the environment. 22

system operation a functionality of the system that can be triggered by a message sent by an actor belonging to the environment. 18